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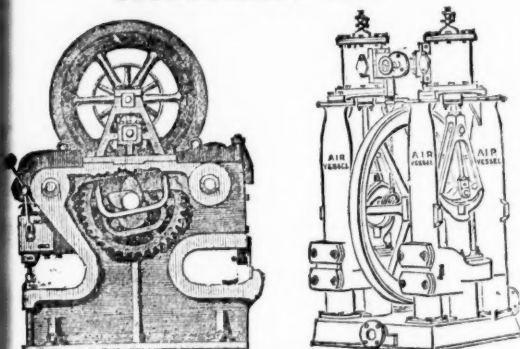
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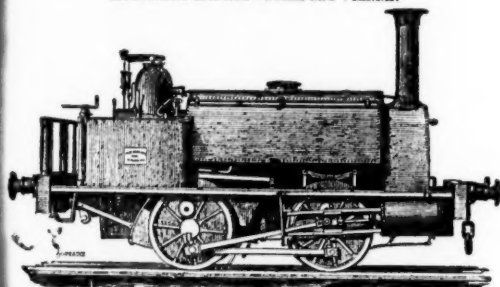
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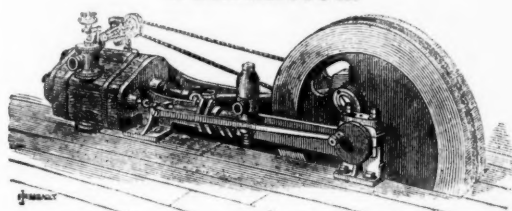
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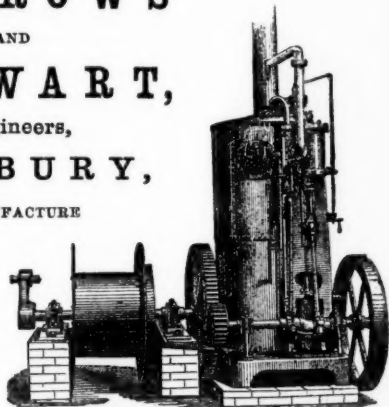
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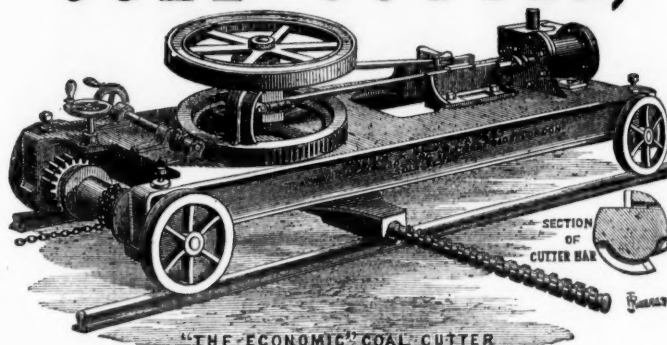
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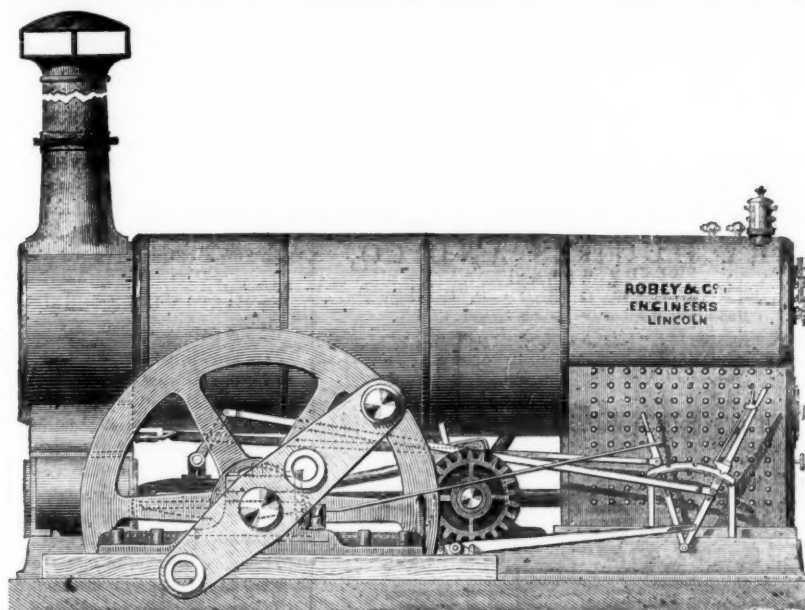
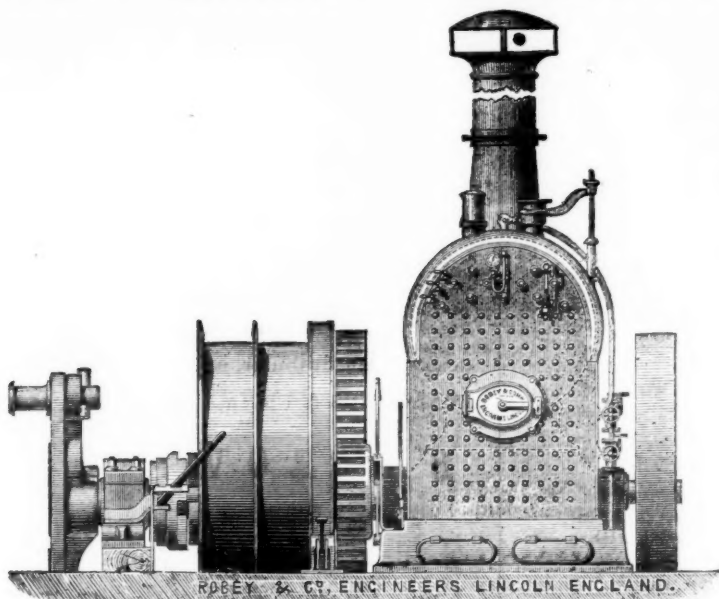
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THE IRON INDUSTRIES OF SOUTH WALES, GLAMORGANSHIRE.

By RICHARD MEADE, Assistant Keeper of Mining Records, Museum of Practical Geology.

In a previous notice we gave a general sketch of the Great Coal Field of South Wales, with statistical information of the production of coal (and ironstone), its distribution coastwise, and quantities exported to foreign countries; also analyses of some of the more important seams of coal in the Glamorganshire area. We will by-and-by refer to the composition of the argillaceous ironstone of the coal measures, and of the hematite deposits of Glamorganshire, giving analyses of the ores; but before entering upon this section of the subject we will in a general way notice the sources of supply of foreign ores, now extensively imported into South Wales and other iron-making districts of Great Britain.

Spain, especially rich in her deposits of ironstone, furnishes large supplies to Great Britain—indeed, her deposits may be said to be almost inexhaustible. However, the disturbed state of that country of late years has greatly retarded the development of this important industry, yet with this disadvantage, it will be seen that while in the year 1864 Spain sent to the ports of Great Britain 43,927 tons of high-class ores; the quantity 10 years later had increased to no less than 790,891 tons, the declared value of this latter quantity being set down at 1,000,720. At Bilbao, near the port of the same name, enormous deposits of a very rich character occur in the carboniferous limestone, and at the Somorrostro Mines, now extensively worked, and situated near Bilbao, upwards of 1000 tons of ore is daily raised. Other important mines yielding valuable ores are situated near Carthagena, Catalonia, Granada, and Santander. The imports of ore from Spain in the year 1873 exceeded three-fourths of the total imports into Great Britain in the same year. The following statement shows the quantities and values of ores imported into Great Britain from Spain in each of the years since 1864. The total imported quantities into Great Britain in the year 1873 amounted to 967,536 tons, of the aggregate value of 1,278,278, against 754,141 tons, of the value of 1,021,481, in the year 1874, showing a diminished importation:

Imports from Spain.

Year.	Quantities.	Value.
1864.....Tons	43,927	£ 32,587
1865.....Tons	37,121	29,476
1866.....Tons	27,619	22,160
1867.....Tons	67,356	54,298
1868.....Tons	88,770	74,635
1869.....Tons	99,816	78,134
1870.....Tons	170,063	145,747
1871.....Tons	302,392	264,255
1872.....Tons	631,134	705,441
1873.....Tons	790,891	1,000,720
1874.....Tons	541,963	665,614

ANALYSES OF SPANISH ORES.—At the mines of San Prudencia, in the neighbourhood of Bilbao, the ore obtained in a nodular state from the deposit of drift is known by the name of "small," while the ore obtained from the deposits in the carboniferous limestone is designated "rock" ore; of these varieties, and of the rich hematite worked at the Campanil and Ollargan Mines—the former of which commands a high price, and is in good request—we have been favoured with the following analyses:—

	San Prudencia.	Campanil.	Ollargan.
	Small.	Rock.	Rock.
Peroxide of iron.....	71.93	79.59	80.06
Protoxide of iron.....	—	—	5.42
Silica.....	9.77	5.34	2.00
Manganese.....	1.95	2.02	2.10
Alumina.....	4.23	1.97	6.31
Lime.....	0.08	trace	0.22
Magnesia.....	trace	trace	0.23
Carbonic acid.....	—	—	3.21
Water and loss.....	11.39	10.81	6.71
Total.....	99.35	99.73	99.90
Metallic iron.....	60.35	65.70	60.25

The Santander ores of the Muliano Mines contain from 72 to 74 per cent. peroxide of iron, equal to 51 per cent. of metallic iron, and the ore of the Muriedas Mines from 84 to 85 per cent., equivalent to 58 or 59 per cent. of metallic iron.

Other analyses of Spanish ores made from three different localities by Mr. Wm. Baker, of Sheffield, give their constituents, as follows:—

	Bilbao ores.		
Silica.....	5.55	1.70	7.65
Peroxide of iron.....	75.80	79.20	78.00
Alumina.....	3.50	4.80	5.80
Protoxide of manganese.....	0.651	2.88	0.83
Sulphuric acid.....	0.068	0.62	0.34
Lime and magnesia.....	trace	trace	trace
Phosphoric acid.....	none	none	none
Water combined.....	11.653	9.672	10.128
Total.....	100.222	100.872	100.748
Loss in drying.....	0.66	1.8	1.6
Metallic iron.....	55.16	55.44	54.20

The total production of pig-iron in Spain in the year 1869 was 40,000 tons, increasing to 72,000 tons in the year 1872. This industry in Spain, however, is in a very backward state, and as wood is beginning to be scarce in the country, and charcoal dear, it has been suggested by those possessing information on the subject that the establishment of ironworks in the coal districts in Asturias in the north, and Seville in the south, would give a great impetus to the manufacture of pig-iron in Spain.

FRANCE, though rich in her resources of iron ore, is largely dependent upon other countries for increased supplies; thus, in the year 1872 she received 99,500 tons from Belgium, 163,500 tons from Spain, 232,800 tons from her possessions in Algeria, and 111,636 tons from Italy. The iron ore raised in France occurs in the oolitic and liassic rocks, the conditions of occurrence being somewhat similar, and it has been remarked that in their general character they are more argillaceous than English ores of the same geological age. The following statement shows the quantities and value of ores imported into Great Britain from France in each of the years since 1864:

Year.	Quantities.	Value.
1864.....Tons	19,454	£12,216
1865.....Tons	19,477	12,765
1866.....Tons	16,064	9,718
1867.....Tons	12,540	7,675
1868.....Tons	10,766	6,074
1869.....Tons	9,424	5,753
1870.....Tons	10,300	6,471
1871.....Tons	16,751	16,522
1872.....Tons	20,077	19,493

Brown iron ore of a sandy character, occurring in superficial deposits in the Wealden rocks between Boulogne and Calais, where it is extensively worked at a small cost, is smelted in admixture with ore from Africa and hematite ore from Cumberland at the blast-furnaces of Marquise and Outreau, the last-named furnaces being situated near Boulogne, on the River Liane.

An analysis of this ore gives of peroxide of iron 49.14 per cent., equivalent to 31.39 of metallic iron, and the only obstacle to its being smelted on a large scale is the want of fuel, the coke employed for this purpose being obtained from Belgium. It is a curious coincidence, and worth noting, that these Boulonnais ironworks should have commenced operations about the time that the Wealden ironworks ceased; these were situated at Ashburnham, in Sussex, and were put out in the year 1828, while those ironworks of the Boulonnais started between the years 1829 and 1834.

It may be of interest here to note the steady increase in the manufacture of pig-iron in France during the past few years, notwithstanding the loss of her ironworks in the basin of the Moselle, ceded to Germany at the termination of the war; the production in each year since 1870 is thus given in an official French return in metrical tons:

Year.	Pig-iron.	Year.	Pig-iron.
1870.....Tons	923,842	1873.....Tons	1,304,715
1871.....Tons	859,641	1874.....Tons	1,423,307
1872.....Tons	1,217,835		

ALGERIA. This important colonial possession of France contains extremely rich deposits of iron ore; at Djebel, near Arrusse, and Sfer, in the province of Oran, specular iron ore is extensively wrought, while at Mokta-el-Hadid, in the province of Constantine, magnetic iron ore is worked. The total exports of iron ore from Algeria in the year 1872 was about 391,000 tons; of this quantity Great Britain received 53,162 tons. In the year 1873 an increased importation took place, 69,856 tons, of the value of 96,964, having been received

at our various ports; in the year 1874, however, there was a falling off, the imported quantities amounting to 62,233 tons, of the value of 79,863; thus, while the average value per ton of the ore in the year 1873 was 28s., the returns for the year 1874 gives about 26s. Algeria, with her extensive deposits of iron ore, possesses but one metallurgical establishment of any importance engaged in the manufacture of pig-iron; these ironworks are situated at Atelik, near Bona, in the province of Constantine, where pig-iron is made from the spathic ores of the district, native coal previously coked being employed in their reduction.

ITALY.—Iron ore exists abundantly in the states of the Italian kingdom. The chief iron ores of Lombardy, of which about 27,000 tons are annually extracted, are spathic or carbonate of iron, and brown hematite, which are found in beds enclosed by metamorphic gneiss in the neighbourhood of the lakes of Como and Iseo, in the Val Sassina, and also in the Bergamasco Mountains, where they compose layers or seams, sometimes 2 or even 3 fms. in thickness, in triassic red sandstone or green slate. The brown hematite contains a considerable proportion of manganese, and is on that account particularly suitable for the production of manganiferous spiegeleisen, or a white radiated pig-iron. In the Island of Elba, on the western side, specular iron ore has been wrought for 25 centuries; it was the mines of Elba that supplied the Etruscans with iron ore for the manufacture of iron long before the foundation of Rome, and the mines are now far from being exhausted. The oldest mines in Elba are those of Rio Marino, but the operations of late years are confined to picking the rich ore from the heaps left by the old workers; these heaps in some places attaining a height of 500 ft. The deposits at Rio Marino are specular iron ore and red hematite, resting upon talcose schist, and covered by crystalline limestone. The other principal localities in the island where these rich ores are wrought are Rio Albano, Terranea, and Cape Calamita, the ores of which yield respectively of metallic iron 61.80 per cent., 65.35 per cent., and 66.27 per cent. The production of the Island of Elba in the year 1872 amounted to nearly 200,000 tons, of which quantity 160,000 tons were exported to Corsica, England, France, and Germany, the remaining 40,000 tons being smelted in the ironworks of Tuscany. The imports of iron ore from Italy do not distinguish the quantities sent from separate states. For the following years, however, we have the total imports from Italy:—

Year.	Quantities.	Value.
1864.....Tons	6,224	£ 6,221
1865.....Tons	4,289	4,271
1866.....Tons	1,292	1,292
1867.....Tons	119	445
1868.....Tons	3,320	3,167
1869.....Tons	47,755	61,091
1870.....Tons	31,729	46,545
1871.....Tons	33,394	46,938

The production of pig-iron in Italy in the year 1872 is stated to have been 26,000 tons, of the estimated value of 156,000, exclusively made by charcoal, although some good beds of anthracite occur at Aosta, in Piedmont; hitherto this fuel has not been employed in the reduction of the ores of iron.

NORWAY.—Magnetic iron ore, or magnetite, has been wrought in the vicinity of Kragero and Arendal from a very remote period; the deposits have a range of many miles in a direction parallel with the coast, and occur in hornblende and micaceous schists. The deposits are not now, it is said, extensively worked, although capable of yielding ore in considerable quantities, but as the yield of metallic iron from the ore does not exceed an average of 40 per cent., it is not exported to any great extent. Since the year 1865 the quantities of iron ore imported into Great Britain from the mines of Norway are as follows:—

Year.	Quantities.	Value.
1865.....Tons	5,850	£ 8,372
1866.....Tons	4,857	5,441
1867.....Tons	5,569	5,367
1868.....Tons	12,073	10,593
1869.....Tons	16,556	12,822
1870.....Tons	15,928	12,532
1871.....Tons	2,284	1,975
1872.....Tons	21,014	25,098
1873.....Tons	16,551	17,985
1874.....Tons	28,690	32,788

RUSSIA.—Iron ore has been in recent years imported from this distant empire. We find the following quantities and values received in the ports of the United Kingdom in each year since 1870; the very high price, however, induces to the belief that it may possibly be chromate of iron rather than iron ore:—

Year.	Quantities.	Value.
1870.....Tons	7,892	£25,415
1871.....Tons	3,888	23,334
1872.....Tons	14,236	94,481
1873.....Tons	4,668	37,606
1874.....Tons	12,244	94,527

GREECE.—Iron ore has recently been obtained from mines in the Island of Seriphos, in the Grecian Archipelago, and smelted at the Royal Greek Ironworks, at Wallend, near Newcastle-on-Tyne; the ores are both magnetic and brown hematite, and some of the varieties contain a considerable proportion of manganese. They have been examined by Mr. Pattinson, of Newcastle, and contain from 45.90 to 57.20 per cent. of metallic iron, and manganese varying from 0.61 to 7.33 per cent. The quality of iron made from these ores is reported good, and suitable for the manufacture of steel. The quantities imported since the year 1870 are inconsiderable, not having in any one year exceeded 1000 tons.

TURKEY IN ASIA has contributed to some extent in furnishing supplies of iron ore, the following are the quantities received in each year since 1870:—

Year.	Quantities.	Year.	Quantities.
1870.....Tons	4436	1872.....Tons	4090
1871.....Tons	6032	1873.....Tons	1329

The quantity received in Great Britain in the year 1874 amounted to 835 tons.

PORTUGAL.—In this kingdom iron ore exists in abundance in nearly all the provinces, giving a high percentage of metallic iron and manganese, and is likely to attract much attention when better known. In the years 1873 and 1874 the returns show the following imported quantities and values:—

Year.	Quantities.	Value.
1873.....Tons	24,812	£32,063
1874.....Tons	29,398	37,969

Having thus briefly sketched the various sources from which the iron ores imported into Great Britain are derived, we now propose to trace the respective quantities imported year by year into the several ports of South Wales.

IMPORTS OF FOREIGN ORES OF IRON.—As previously stated, the native mine and hematite, the produce of South Wales, is far from sufficient to meet the growing requirements of the ironworks; again, the cost of production of the native mine has been greatly enhanced of late years, from increased depth of workings, and cost of labour, these and other causes inducing our ironmasters to look abroad for additional supplies of ore, which are secured to South Wales under most favourable circumstances, its export trade in coal being considerable, the colliers thus employed returning in ballast with rich specular and hematite ores of iron from Spain, Algeria, Elba, &c., but for these supplies many of the blast furnaces of South Wales would long since have ceased working. To show the yearly increase of these supplies we note the following details of ore imported into the undermentioned ports of South Wales in each of the years from 1850 to 1863, and side by side, for comparison, the total imports into Great Britain in each of the same years:—

Year.	Cardiff.	Newport.	Swansea.	Great Britain.
1850.....Tons	590	25,895	38	26,333
1860.....Tons	4,946	14,575	80	21,112
1861.....Tons	6,134	11,923	2074	23,442
1862.....Tons	9,587	23,339	—	36,270
1863.....Tons	19,435	11,253	5952	62,167

In subsequent years the values of the imported ores are returned; to show their increasing importance the following abstract has been prepared, giving quantities and values:—

Year.	Newport.	Year.	Cardiff.
1864.....Tons	16,174	1864.....Tons	33,673
1865.....Tons	17,144	1865.....Tons	34,859
1866.....Tons	7,029	1866.....Tons	24,566
1867.....Tons	12,257	1867.....Tons	49,327
1868.....Tons	17,662	1868.....Tons	50,104
1869.....Tons	35,934	1869.....Tons	55,163
1870.....Tons	41,176	1870.....Tons	69,181
1871.....Tons	46,947	1871.....Tons	269,479
1872.....Tons	75,531	1872.....Tons	312,379
1873.....Tons	86,066	1873.....Tons	227,084
1874.....Tons	95,786	1874.....Tons	264,785

Year.	Quantities.	Value.	Year.	Quantities.	Value.
1864.....Tons	15,600	£ 9,474	1870.....Tons	52,162	£ 55,842
1865.....Tons	9,830	6,374	1871.....Tons	77,963	57,224
1866.....Tons	11,128	6,613	1872.....Tons	133,182	164,013
1867.....Tons	13,781	—	1873.....Tons	120,810	155,541
1868.....Tons	13,595	10,236	1874.....Tons	84,863	102,041

The Port of Llanelly also received in the years 1872 and 1873 2987 tons and 4095 tons of ores of iron, of the value of 2983, and 5815, respectively.

A summary of the above-named quantities and values of iron ores imported into South Wales shows the following as the total imports since the year 1864; side by side, for comparison, we give the aggregate imports into Great Britain of iron ore of all kinds in each of the same years—a considerable falling off being observable in the year 1874, principally from Spain:—

SOUTH WALES.				GREAT BRITAIN.			
Year.	Quantities.	Value.		Quantities.	Value.		
1864.....	Tons 65,447	£ 46,963		Tons 74,163	£ 55,702		
1865.....	61,633	47,996		76,977	72,491		
1866.....	42,723	31,996		56,689	49,081		
1867.....	76,889	—		86,569	—		
1868.....	81,361	62,791		114,438	94,820		
1869.....	95,000 (estd.)	—		131,321	101,644		
1870.....	139,249	101,136		208,310	166,190		
1871.....	231,671	156,426		324,034	343,175		
1872.....	452,558	489,124		801,593	1,014,842		
1873.....	617,980	612,687		967,536	1,278,278		
1874.....	398,013	465,612		754,141	1,021,481		

A careful analysis of these quantities and values show that in the year 1864 the average value of the imported ores was about 15s. per ton, increasing in the year 1868 to 16s. 6d. per ton, and in 1870 receding to 16s., while in subsequent years, in 1871, it reached 21s. per ton, and in the year 1872 to 25s. per ton.

The year 1873, characterised by the high price of coal, while seriously affecting our metallurgical and other industries, does not appear to have led to diminished imports of iron ore; on the contrary, there was an increased importation into South Wales of 65,422 tons, and into Great Britain of 166,033 tons, the average value of the ore being 25s. in the year 1872, and 26s. 6d. per ton in the year 1873.

The imports of iron ore show a considerable falling off in the year 1874, as compared with the previous year, amounting in South Wales to 119,967 tons, of the value of 147,025, and in Great Britain to 213,395 tons, of the value of 256,797, the average value per ton not exceeding 24s. From Spain alone, as previously stated, the imports fell from 790,891 tons in the year 1873 to 541,963 tons in 1874, a deficiency amounting to 248,928 tons, and representing the non-employment of tonnage of shipping to that extent.

A reference to the annual returns published by the Board of Trade gives the following information of the quantities of ore imported into the United Kingdom in each of the years 1873 and 1874 distinguishing the respective quantities received from each foreign country:—

Countries.	1873.	1874.
Algeria.....Tons	69,856	62,233
France.....Tons	16,761	20,077
Italy.....Tons	31,729	33,394
Norway.....Tons	16,651	28,680
Portugal.....Tons	24,812	29,398
Spain.....Tons	790,891	541,963
Sweden.....Tons	4,668	12,244
Russia.....Tons	12,168	26,111
Other countries.....Tons	—	—
Total.....Tons	967,536	754,141

Of the 754,141 tons of foreign iron ores imported into the United Kingdom in the year 1874, there were imported into the River Tyne, Newcastle, &c., 128,378 tons, received from the following places:—

Countries.	1874.
The Netherlands.....Tons	302
France and Algeria.....Tons	13,173
Russia.....Tons	25
Italy.....Tons	12,108
Spain and Portugal.....Tons	81,712
Norway, Sweden, and Denmark.....Tons	2,618
Austria, Turkey, and Greece.....Tons	17,208
United Kingdom.....Tons	100
South America.....Tons	1,137
Total.....Tons	123,378

ANALYSES OF THE IRON ORES OF GLAMORGANSHIRE.—The "Iron Ores of Great Britain," Part III., contain an interesting series of analyses of the ironstones raised and smelted at the important and extensive ironworks at Dowlais; these analyses were made by Mr. Edward Riley for the proprietors. The following shows the composition of the ironstone of the "Dowlais Rosser Vein Mine," this measure of ironstone is above the Lower Rosser Vein, and occurs in balls with a very strong appearance and fracture; the sample subjected to analysis was taken as an average:—

Dowlais Rosser Vein Mine.			
Soluble in acids.		Insoluble in acids.	
Silica.....Grains	0.27	Silica.....Grains	18.08
Protoxide of iron.....Grains	41.03	Alumina.....Grains	5.56
Alumina.....Grains	0.23	Peroxide of iron.....Grains	0.42
Protoxide of manganese.....Grains	0.55	Lime.....Grains	0.17
Lime.....Grains	2.83	Magnesia.....Grains	0.25
Magnesia.....Grains	3.11	Potash.....Grains	0.88
Carbonic acid.....Grains	28.49	Total.....Grains	99.54
Moisture.....Grains	0.57		

The metallic iron

valent to 48.934 per cent. Another variety of hematite from the carboniferous rocks of Llantrisant, examined by Mr. E. Riley, shows the following constituents, and gives 41.34 per cent. of metallic iron:—

Llantrisant ore.	
Peroxide of iron	69.05
Protoxide of manganese	0.09
Lime	0.23
Alumina	—
Magnesia	0.28
Phosphoric acid	0.06
Sulphuric acid or pyrites	0.09
Silica	34.40
Water	0.28
Total	100.69

The hematite of Whitchurch, near Cardiff, in Glamorganshire, calcareous in character, and oolitic in structure, gives 47.468 per cent. of metallic iron; this ore has been examined by Mr. W. Ratcliffe, who has determined its composition as follows:—

Results tabulated.	
Sesquioxide of iron	68.554
Protoxide of iron	1.131
Oxide of manganese	1.127
Alumina	1.753
Lime	8.547
Magnesia	1.116
Silica	0.312
Potash	0.190
Soda	0.493
Carbonic acid	5.733
Sulphuric acid	1.309
Phosphoric acid	1.017
Organic matter	0.378
Water	2.118
Ignited insoluble residue	10.356
Total	101.707

Ignited insoluble residue.
Silica 8.559 Potash 0.235
Alumina (with a little iron) 1.042 Soda 0.076
Lime 0.850
Magnesia 0.272 Total 11.064

No metallic perceptible by sulphuretted hydrogen from the hydrochloric acid solution of 300 grains of ore was detected.

In our next notice it is intended to trace the progress of the manufacture of pig-iron in Glamorganshire, in those districts in which bituminous coal is employed in the reduction of the ores; to give an account of the mills and forges, tin-plate and steel works, their production, and to consider the quantities of ore, coal, &c., used in these industries, reserving for a subsequent notice the progress of the pig-iron manufacture in those districts of Brecknockshire, Carmarthenshire, and Glamorganshire in which anthracite has been and is now employed in the blast-furnaces.

Original Correspondence.

CARRIAGE OF EXPLOSIVES BY RAILWAY.

SIR,—I am glad to find that public attention is being called to the great difficulty thrown in the way of mine owners by the short-sighted policy adopted by certain railway officials in refusing to carry explosives. I quite agree with your correspondent, "A Mine Owner," that the necessities of trade must be met, and explosives must be had, and if not openly carried by railways they will be covertly, and it is, indeed, notorious that they are so now.

It is impossible to look into the Act of last session without seeing that it was the intention of Parliament that the railway companies, to whom a monopoly of the carrying trade has been granted, should carry all explosives, subject to proper regulations; for section 35 of the Act requires every railway and canal company over whose railway or canal gunpowder is carried to make bye-laws as to notices to be given, and the way in which explosives are to be packed, and marked, &c., for carriage, and generally for the protection of persons and property from danger during carriage; and penalties are imposed on parties who shall neglect to observe such bye-laws, but there is no penalty imposed for the carriage of any explosive except on breach of such bye-laws; and what is more, the Act relating to the carriage and deposit of dangerous goods, and the Gunpowder and Nitroglycerine Acts, which imposed very severe penalties on parties for sending nitroglycerine and other explosives by railway without notice, are repealed. If I am right in my reading of the late Act of Parliament it follows that there is no penalty imposed by it on parties who send gunpowder, dynamite, and other explosives by railway where bye-laws have not been made, and it must, therefore, be inferred that railway companies refusing to make such bye-laws, and to consent to act on them by openly carrying explosives, desire to lend their aid to parties in evading the reasonable restrictions which Parliament intended to impose for the protection of the public.

As one of the public deeply interested in the prosperity of the district in which I reside I protest against this state of things. I desire, as a mine owner, to get dynamite, and am willing to pay for its carriage, subject to proper facilities for the protection of the carriers, their servants, and the public. I prefer doing this to having the carriage smuggled at less cost. Mine owners must use explosives, and desire to get those that best serve their purposes. They have promoted the formation of the railways, and assisted in securing to them the monopoly of the carrying trade which they enjoy, and they feed and keep them going, and have a right in return to have not some only but all their goods carried at reasonable rates.

The members of the Railway Clearing House appear to have assumed to themselves power to over-ride the intention, if not the provisions, contained in the late Act of Parliament, and it certainly appears to be most strange that the railway company which derives the largest revenue from the carriage of minerals—and I believe there is no doubt that the London and North-Western Railway does—should be the one to lead the way in opposing the mining interest by refusing to carry the particular explosive which best serves their purpose, as being the safest, most economical, and serviceable in certain cases.

The anomaly is so great that different motives have been suggested, and amongst others it has been surmised that certain influential parties may possibly have an interest in the promotion and sale of certain explosives, and consequently of throwing impediments in the way of consumers getting others. If such is the case the apparent perversity of the parties alluded to may be accounted for, but the sooner such conduct is exposed the better. Certain it is that some mysterious agency is at work in the clearing house at Euston, for one party who professed to come from there was bold enough to present himself before the Parliamentary Committee of last session and tried to prove that a case of dynamite had fallen from a railway truck and exploded, causing great damage. His statement was that he had heard of such a case, but on being questioned could not explain or say when, or where, this alleged accident had taken place, and this hearsay tale was afterwards distinctly proved to be a pure fabrication, and that no such accident had occurred, but every case or parcel of dynamite which had been sent by railway had been delivered to the consignee, and paid for by him to the sender.

Truro, Jan. 26.

— ANOTHER MINE OWNER.

EXPLOSIVES USED IN MINES.

SIR,—The protracted depression in tin renders economy absolutely necessary. There exists between the manufacturers, owners, or patentees of dynamite, cotton gunpowder, or lithofracteur an union in the agreement come to that there shall be one price for each—200l. per ton. When we know that dynamite can be purchased in Hamburg at 130l. per ton, we can only curse the existence of a law that enables one man to take advantage, and that exclusively, of another man's discovery to monopolise exorbitant profits. Neither Germany nor the United States recognise Nobel's patent. The proprietors of Nobel's patent brought an action against Prof. Mowbray in the United States Courts, and were ignominiously beaten, and had all costs to pay. A few months ago Messrs. Krebs Brothers, of Cologne, manufactured a new explosive for Mr. Braine, of Cladderford, Gloucestershire, which was as much superior to dynamite as dynamite is to ordinary blasting-powder, and equally as safe to transport or handle. Messrs. Nobel or others interested in dynamite, finding a dangerous competitor had appeared in the field, at once served Messrs. Krebs with a notice of Chancery proceedings, on the plea that nitro-glycerine formed the base. Mr. Nobel had no more claim to the discovery of nitro-glycerine than John Chinaman had to the invention of the locomotive. However, the patentees of the new explosive, Mr. Braine, does not feel disposed to contest the action, so we must submit still to the monopoly and union.

I am glad to see in last week's Journal that a new explosive has been discovered by Capt. E. A. Bjorkman. This new explosive is called Vigorite, and from its composition one would suppose to be a formidable disruptive power. This Vigorite is formed of 25 to 50 per

cent. of nitroline, nitrate of potash 15 to 25 per cent., chlorate of potash 10 to 30 per cent., and 15 to 35 per cent. of cellulose. As the power of explosives consists entirely in the suddenness and power of expansion of all their elements, we may hope to have in Vigorite a powerful aid to the miner at a reasonable price. Unionism on the part of producers is only to be met by union or combination of consumers; let all the mine agents of Cornwall and Devon unite and refuse to use another cartridge until dynamite and cotton gunpowder are reduced to a reasonable price, and a price at which they are sold in Germany. Treble charged detonating caps of 54 grammes, the best and strongest made, I shall be glad to supply at 28s. per 1000. The present price charged the miner in Cornwall is 35s. per 1000 for an inferior article. The cost price of the above caps may be even less than 28s. if a large quantity can be taken.

The use of strong detonating caps, even when the ordinary blasting powder is used, is of great advantage. If the cap be inserted 2 or 3 in. in the gunpowder cartridge there is a probability of increased power from the more perfect and sudden explosion. How far chlorate of potash is capable of admixture with ordinary blasting powder, or any other equally rapid combustible, is a question manufacturers of powder can answer. There can be no question that the introduction of dynamite has resulted in an excessive expenditure, without an equivalent advantage. Dynamite is used or allowed to tear a burden that ordinary gunpowder would equally effect, while the nitric acid given off forms but an excuse for an additional quarter of an hour's extra "quitting."

It is greatly to be regretted that mine agents and mine managers have no place of meeting, or counsel chamber, where they can meet and discuss anything and everything relating to the interests of the adventurers, their employers. Their positions are critical—twelve months more of the present depression and who shall say there will be a dozen mines working in Cornwall. What have the agents of Cornish mines done to improve the development of their mines, or render less costly the ton of tin sent to market? As a rule every suggestion of a different mode of proceeding is ridiculed—ways and thoughts are stereotyped.

IL. WADDINGTON.

Wheat Agar, Pool, Cornwall, Jan. 25.

THE PREVENTION OF ACCIDENTS IN COAL MINES.

MR. COLWELL'S SYSTEM OF VENTILATION.

SIR,—It now becomes my privileged duty to submit for public approval the result of my common-sense interpretation of the laws of natural philosophy bearing upon this all-important subject. Although this has been delayed for 14 years the fault has not been mine, neither do I now wish to fix the blame, as I might do, by indisputable evidence which I still possess. Influenced by the dictates of humanity alone I have long fought against desperate odds in this truly Christian cause, and that at a ruinous cost to myself without the reward of a single penny. This I never sought, neither do I seek it now, but the recent appalling catastrophes in collieries induced me to waive all past injustice and to address you once more.

My recent renewal of this subject through the *Mining Journal* seems to have aroused an interested few from their lethargy, if of the old school, or it may be, as I know them not personally, some younger branches of those in the management of collieries who now invite me by letter to disclose further details of my plans through your instrumentality. I am, therefore, more disposed to yield to such requests than to anonymous applicants who shield themselves under initials only in treating with a man of sufficient moral courage to attach his name and address to his public views, although opposed to those of a very numerous body of learned and truly scientific men. All I ask is "fair play, an open field, and no favour." I have been a conspicuous target for some years, but I am not even wounded yet, except in purse, and still hope to convince my primitive opponents that I shall die gamely if even defeated in my strenuous efforts to remove their powerful prejudice in favour of furnace ventilation.

I will now proceed to define, as requested, the simplicity of my plans to secure the future safety of the poor pitmen, from whom I have neither sought nor received the slightest reward beyond a public vote of thanks, years ago, from a large body of their delegates. In doing so I must repeat much which appeared in your columns in February, March, and April, 1862. The Montague Main Colliery is situated at Scotswood, near Newcastle-upon-Tyne, and by previous arrangement with its owner (Mr. W. Benson, of Hexham), on Feb. 1, 1862, I descended the colliery in question by means of a looped rope, or jack, owing to an accident to the usual machinery. The air is supplied by means of a common blast-furnace fan, 6 ft. by about 18 in., conveyed by a wooden box or case from the surface to the Beaumont seam 30 fms (which is worked out), and from thence to the Three-quarter seam, about 18 fms. lower down, by an air-tight bratticed shaft, forming the upcast and downcast. I closed the former at the Beaumont seam, until by the barometer I ascertained an internal pressure equivalent to 16 lbs. per inch throughout the mine; and, believing from appearances in general, and the difficulty to prevent the clay stoppings around the platform upon the pit frame from being blown out, that a suitable atmosphere for all purposes was obtained, I removed the valve and covering, got the men up from below, and was pleased to learn from them that they had experienced no inconvenience whatever. They said the air was cool and comfortable, that it strongly rushed past them at intervals (when I removed the valve to examine the barometer), and that they should have no fear of gas with so much air in the pit as they had then experienced for the first time in their lives. The manager concurred, and the owner was much pleased to hear from their own lips the result of this first trial, he having arrived at the pit's mouth as we came to bank. I must, however, for the moment pass over his kind expressions of satisfaction to recapitulate facts which I described in the Journal in continuation of the above.

The limited space to which I must necessarily confine my arguments in your columns precludes the possibility of my quoting acknowledged authorities to confirm my statements in detail, as to existing evils and abuses, which alike require to be remedied, but for the sake of brevity I will take the following propositions as admitted:—

1. That more air is needed, as a general rule, if it can be obtained without increasing the speed of the current.—2. That in every colliery in the kingdom the air is more stagnant in some parts than in others, less filled in places remote from the main drift, where explosive and deleterious gases are mostly given off, or accumulate, and where it is most difficult to obtain the counteraction of the natural pressure of the atmosphere.—3. That in many mines the coal is worked to a considerably greater height than the average dimensions of the ventilating current. That undulations of the roof, from falls, occasion immense "swilley's," in which light and dangerous gases abound, in the absence of artificial means to sweep them occasionally into the passing stream of expanded air. That sundry spaces exist in which these dreaded enemies may again deposit themselves unobserved, between their former receptacles and exit, and hence a source of great danger.—4. That if the men dare not use an unprotected light to enable them to earn their daily bread the atmosphere of some such mines is unfit for human respiration.—5. That atmospheric changes upon the surface quickly operate upon the air below. That with a fall in the barometer, and consequently lightened internal pressure of the atmosphere, gas is acknowledged to be discharged abundantly from goaves, blowers, and other places, and the more so when, with a such a fall in the barometer, a rise in the thermometer occurs. And it is further admitted that upon a contrary change, when the internal pressure of the air is increased, the gas recedes from the superior force, which then penetrates the very holes which a few minutes before were discharging volumes of deadly vapour.

Having given the depth of the pit in question and the means by which it was filled to compression, I will endeavour to fix attention upon the course I intend to pursue if permitted, as I hope to be, to complete my system at Scotswood, but as collieries differ in depth and extent—some fiery and others not—some ventilated by means of a single shaft, others with more than one—the difficulty I experience in defining the adaptation of my plans may be easily imagined, and to attempt a fixed rule for all may be deemed absurd. I intend, therefore, of all interested in the subject not only to listen to reason,

but to reflect before they reject or condemn, which many are too apt to do in all cases of suggested improvements upon what they vainly consider perfection. In the first place, however, it must be determined what degrees of compression will render the escape of gas harmless; but, in ascertaining this due regard must be had to the health and comfort of the miner. If the desired degree of compression can be obtained by the common fan, as I know it can, then there would be no need of expensive machinery for propulsion. It will no longer be a question of great speed through the main airways only, the additional quantity and its equal spread throughout the entire ramifications of the whole is, to my mind, the principal consideration; and as none will be permitted to pass away, except into the fissures, cracks, chinks, blowers, goaves, &c. (from which the gas had previously exuded), until every part is filled to the desired extent of air, and I apprehend no extensive power can be needed.

I do not remember the number of cubic feet of air per minute supplied by the fan, but when in the pit I thought it equal in strength and quantity to any other within my knowledge. It was considered a very safe pit, and I had but a few hours before been down another belonging to Mr. Thos. Young Hall, which was ventilated on the furnace principle. Still I perfectly well remember that by stopping all escape upwards the enormous pressure of 16 lbs. to the inch was obtained in less than one hour; and, as one of the men said he felt a pressure upon the burrs of his ears as if some one was pressing his fingers upon them, I consider 16 lbs. to the inch suitable for all purposes both as regards health and safety.

Assuming, then, that so far I have made myself understood, I next propose to convey the air from the fan to the pit bottom by means at present existing, and to leave the question of directing its course to the present officials in charge, my only duty being to explain how to ensure whatever quantity may be determined on; how to maintain it at all times, irrespective of atmospheric changes upon the surface, which can no longer act below; how to secure an equal spread and pressure throughout the pit, and infallibly to regulate its ingress and exit to any degree desired.

In order to make myself more clearly understood I must remind your readers of the simplicity, but wonderful power, of "locks" upon rivers, &c. How laden vessels can be speedily raised and passed onwards from a very low level to a very high one, or the reverse, as a simile to the system I am about to introduce. The wall of coal may be compared to the river banks, and the double doors, which I shall now describe, for collieries may be likened to the water-gates or locks in question. And, knowing something of the law of hydraulics, as well as the doctrine of pneumatics, I believe all concerned scientifically in this matter will acknowledge the simplicity of the two.

Now, Sir, as the extent of works varies, so must the space between the double doors in main airways according to the average length of coupled trucks drawn by ponies, therefore in the Montague Main I will assume 15 yards, so that at about 20 yards from the foot of the upcast shaft I should fix the first pair of double doors air-tight; another pair 15 yards beyond, and again at a similar distance, making in all 55 yards. At each of these divisions should be constructed a small aperture with an appliance to relieve the interval pressure upon the doors by filling the last compartment (which I will now call the first) to an equal degree of that within, so that they might open freely like the flood-gates, and thus open a passage for 15 yards towards the upcast. On opening the next aperture the doors behind will close of themselves, and thus prevent any further escape; and so with the third, when all may pass onward like the laden vessel, but in this case with the delay of one minute only.

It is now necessary to speak of the proposed upcast, and instead of more space being required for the exit than the entrance of the air, as is now absolutely necessary, and in some cases to the extent of two-thirds of an enormous shaft, I believe that a metallic pipe of a few inches diameter will be ample for the liberation of the atmosphere when under compression; and hence, not only an immense saving of space, but a corresponding saving of future expense in the sinking of shafts in general, such pipe to extend from the inside of doorway No. 1 to the shaft—say, 60 yards—turned upwards, beyond the reach of idle curiosity or possibility of being tampered with, and which may be varied in form to suit the tastes of owners or viewers, but to be regulated to the degree of the required internal and upward pressure, covered at top by a weighted valve, so as to regulate the discharge in precise ratio with the supply, which would be continuous, but every inch of the whole interior of the mine would then be subject alike to whatever resistance it may be found necessary to apply for the prevention of the emission of all explosive and deleterious gases, and so continue from day to day. As the air must necessarily penetrate the goaves, distinct return airways from these could easily be made, remote from any passage to be traversed by men or boys, and thus conduct the whole of the passing current through the goaf to the upcast through passages sealed from intrusion by the operatives, and into which no light need ever enter.

Now, as regards costs to be incurred, it will be seen that three pairs of doors and 60 yards of 3-in. pipe with valve are alone necessary, and these with fixing complete might amount to 50l., or at most 100l., for such a pit as the Montague Main, which is already ventilated by propulsion.

In collieries where the furnace is in use the additional cost of the fan would be necessary, and in lieu of a wooden box for a downcast I should advise a 12-inch pipe as sufficient for any colliery, as it can be quickly filled to compression by such means while the upcast is closed, and I believe it will be found sufficient to maintain the supply when the valve lifts for its escape, but as an additional means of security I recommend that another valve in all cases, but of reverse action, should be attached to the lower extremity of such pipe, so as to avoid escape if from any cause the fan should cease to operate.

To estimate the cost of the latter is neither within my province nor knowledge, but I roughly guess it at an average of 500l., in order to compare it with the enormous saving to be effected if proved to be more powerful than the furnace, which for fuel alone would be equal to, perhaps, 3000l. a year. Add to this the saving in brattices, &c., together with the probable saving of from 70,000l. to 80,000l. for each additional shaft required by the present system if propulsion as I have described should fully answer my expectations, and I think it must be admitted that I have made out a case worthy of some consideration, and less of the offensive and anonymous trash to which I was formerly subjected as the advocate of the helpless.

With such a system in operation it may soon be known whether the air can be circulated as well, or better, than under the present means adopted. Would the entire atmosphere of the mine be better suited to the health and comfort of the miner? Would the risk of sudden death or mutilation be reduced? Would the necessity for more shafts be greatly obviated? And, lastly, would the continual dread of the poor pitmen and that of their wives and families be removed? To all these interrogatories I confidently and fearlessly answer in the affirmative.

I have unavoidably omitted some minor details, together with the evidence on which I rely to remove all scruples as to the fallacy of present practices, still my humble views are submitted for mature consideration and optional adoption, if found on trial to be correct in principle, and if not sufficiently defined I shall be happy to supply any additional information which may be sought in the same spirit with which I have hitherto been actuated in my humble efforts to protect the lives, and to ameliorate the condition, of all employed in the coal and ironstone mines of this country.

For 20,000,000l. sterling Great Britain purchased the freedom of the negro, and all admit to the present day this was a blessed deed. But the negro with all his hardships was permitted to enjoy the light of day and repose by night; he was never driven down to so dimly dark a cavern as a British colliery to labour for his daily bread. Neither has the miner enjoyed much of a sunny sky or the pure air of heaven to breathe; it has been his lot, although a freeman, to labour alternately as "shifts" occur, by night or by day, in a pestiferous atmosphere, to youth upwards in total darkness, except the glimmer of a faint lamp-light, which he dare not increase by exposure lest he and hundreds more should be blown to pieces.

The miners, like those abroad who still remain in bondage, do their

slavery in a state closely bordering upon nudity; they are alike in colour during the miners' toil, both are equally entitled to our commiseration, and, therefore, however much we may compassionate the foreign slave, I have beheld such heart-rending scenes in colliery districts as to make me hold fast to the cause of our suffering fellow-countrymen of this pitiable grade with at least as much sympathy as any man can possibly entertain for the cruelly treated foreigner.

In conclusion, I supplicate, as an act of justice long deferred, all those whom I now emphatically address to waive their prejudices, as I have done, and endeavour henceforth to ameliorate the sad condition of those they employ by at least giving a fair trial to all suggestions means to protect them from unnecessary slaughter, and thus gladden the hearts of many thousands.

C. COLWELL.
Southtown, Yarmouth, Jan. 24.

COLLIERY EXPLOSIONS.

SIR,—I have carefully read the article in last week's Journal, but I cannot see much advantage to be derived from the suggestion of "boring a number of holes below the lowest coal veins," and then lining them with tubing. This tubing would prevent the gas escaping, except from the bottom, and if not tubed the holes in many cases would fill the workings with water. The writer is quite right in saying "the gas once tapped off, explosion will be far," but in my opinion the suggestion as made by Mr. Smedley will fail in most cases to "tap it off." Instead of boring holes I would, as I have often done before, suggest proper natural drainage. This I know is done effectually in some parts of Yorkshire in fiery mines—drains cut in the roof in the return air-way, commencing with nothing, and keep the top of the drain lively, and cut through into the goaf, and the gas will go away of itself, and empty the goaf up to that level line, therefore the question of moving the gas from the old goaf is in my opinion only a question of proper natural drainage. Drains properly cut would have moved the gas from the abandoned places in Swaithe Main, and also the old 12-acre goaf, and it is the gas that wants taking away, or, in other words, allowing it to go away, then shot-firing properly can do no harm.

I know the system of working and ventilating the Thick coal in the Barnsley district in many cases is such that the gas is prevented getting away from the working face even before any fall takes place in the roof. I have seen men at work in the Swaithe Main Colliery with a Stephenson lamp hung about 2 ft. from the floor, and at the same time, about 4 ft. above that lamp, the gas ignited in a Davy lamp, but the Stephenson continued to burn, and the men continued to work as if all was right while their lamp would give them light. This, to my mind, is a great drawback to the Stephenson lamp, and has often been the source of mischief when in the hand of an ignorant workman. It, no doubt, possesses all the other good properties claimed for it in other respects. I cannot see how shot-firing can be accomplished with a Stephenson lamp, except the "short-glass Stephenson," in which the inner glass tube is shortened so much that a small wire can be inserted through the gauze, and heated for the purpose, and in that case the lamp certainly ceases to be a Stephenson. Drains can be cut to any height by commencing further back; the flatter the seam, the longer the drain. The Barnsley seam I take to be about 1 in 12 or 1 in 14. If the drain were not cut the gas would have to come down before it could escape, which it would not do without some force being employed in some way, which might be a fall from above; this is often the case.

M. C.
Jan. 25.

DRAINING OFF EXPLOSIVE GASES.

SIR,—In the article in last week's Journal referring to the Swaithe Main explosion the writer quotes the recommendations of Mr. Hubert N. Tweddle, of Pittsburgh, suggesting, for the safety of human life in colliery operations, the value of, so to say, draining off the explosive gases. The principle is unquestionably right, as is also his mode of effecting the object by boring from the surface, where it is applicable; but in many cases in this country where the coal measures are covered by the chalk or "kreide" formation, and in the North of England, where they are covered by the magnesian limestone—both of which generally contain large supplies of water—to bore holes of 8 in. diameter would be, most probably, to flood the collieries.

Nevertheless, the object should, where practicable, be effected, and this can in most cases be done by piping the gases from the highest level of old "goafs" through the workings and the upcast pit to the day. I believe this has been done in the construction of a shaft at Page Bank, in the county of Durham, by the famous pit-sinker, Mr. Coulson, and I remember seeing, to the east of Newcastle-on-Tyne, a supply of gas through, I believe, a bore-hole burning for many years.

In searching for coal by borings in Westphalia, even though the bore-hole be full of water, gas escapes and can be lit up at the surface. In any event the draining off of gas from old "goafs," especially from the "rise" of collieries, should, wherever practicable, be carried out.—*Düsseldorf, Jan. 26.*

WM. T. MULVANY.

CONTINUOUS RAILWAY BRAKES.

SIR,—The lamentable accident at Abbot's Ripton should suffice to induce our legislators to make the use of continuous brakes upon every train running more than five miles without stopping absolutely compulsory, for from what has already been elicited in evidence I think it must be acknowledged that there is not a shadow of a doubt that had the express trains which have been smashed up been provided with sufficient brake power the fearful sacrifice of life would have been prevented. So long as our present views of the necessities of travelling continue we must provide for an average speed of 50 miles per hour, and on the best systems of block signalling an average of one signal for every five miles of road is as much as can reasonably be expected—indeed, I very much question whether the indefinite increase of the number of signals conduces to the safety of the travellers. The primary cause of all railway accidents is unquestionably want of punctuality, and I cannot find the record of a single accident which has occurred when time has been kept by the trains in motion. The reason of this is not far to seek. When punctuality is the rule, and not the exception, the lines are cleared as a matter of course before the coming train is due, and order and punctuality become habitual with every servant of the company. When the trains are not habitually punctual the company's servants rapidly contract the habit, which constantly grows upon them, of going on with the ordinary work of shunting, and so on until the signal "train on" is actually received, and then the slightest extra weight of a truck or train being shunted upsets the calculation, causes those in charge to become flurried, and as a result the fast train is upon them before they are ready for it. This was precisely the case at Harrow, when several were killed and a large number injured. At Abbot's Ripton the accident was also the result of want of punctuality, but this was certainly due to exceptional circumstances—bad weather and a blinding snowstorm.

It is but due to the Great Northern Railway Company to say that the punctuality maintained upon that line is, as a rule, marvellous. The starting of the trains is accurate, and the arrival after 200 or 300 mile journeys is usually within two or three minutes of the time stated in the tables. But with all care for safety accidents will occasionally happen by which the lines become blocked, and hence it is essential that every train should have the power of stopping within the shortest distance practicable, and this can only be attained by the use of continuous brakes. Now, the bringing to a standstill of a heavy train running at a speed of 50 miles an hour is by no means so simple a process as some suppose, yet with proper appliances, and allowing a reasonable distance, it is not impracticable. The driver of the down express has been complained of because he did not at once reverse his engine when he saw from the signals on the engines he met that something was radically wrong. No complaint can be more groundless; it is admitted that he at once cut off the steam and had the brakes applied, and this was the correct thing to do, as well as all that could properly be done. To have instantly reversed his engine would undoubtedly have done more damage than was really done, for his own train would have been more completely smashed up, and the loss of life would certainly have been augmented. When a train is running at

50 miles an hour the impetus which it acquires is enormous, and in stopping it much judgment must be used in overcoming this impetus, or the remedy will prove to be worse than the evil.

To suddenly reverse an engine when it is running at 50 miles an hour would be very liable to throw the train off the line, the reason being that the stopping power is applied at the wrong place; for the stopping power to be effective in overcoming the impetus it must be applied first at the back of the train, and then to each carriage further forward. Some ten years since a very efficient brake upon this principle, the invention of Mr. Ch. Boutet, now of Bourges, France, was, I believe, exhibited to the directors of the principal English railways, and its efficiency acknowledged. Another equally good brake has since been invented by Mr. François Martin, of Ternes, Paris. Now, both these inventions are well worth patenting in this country, and I believe satisfactory arrangements could be made with the inventors for the transfer of their rights. The only objection raised to either is that they would cause more wear and tear to the railway material now in use. This, no doubt, would be, but it is impossible to have any instantaneous brake without increasing the friction which has already been proved insufficient to stop a train within a safe distance; but as the instantaneous brakes might be used as supplementary to the two or three brakes now used, there is no real objection to their introduction. The instantaneous brakes need only be employed in emergencies, and the slightly extra wear and tear of material is certainly not comparable to the saving of human life. Either of the brakes in question will stop a train without jolting the passengers in its own length, and if this could have been done at Abbot's Ripton not only would 13 or 14 lives have been saved, but the company would have saved in compensation an amount which would have paid for the new brakes and the damage caused by them in perpetuity.

PHILO.

TRAMWAY LOCOMOTIVES.

SIR,—It appears to me that of late so many improvements have been made in the construction of light locomotives that there is now no real objection to their general use on tramways, at least beyond the limits of crowded towns. The great point appears to be to reduce the size of the boiler and furnace to the greatest possible extent, and the adoption of the rotary engine directly upon the axle of the driving wheels as the means of propulsion. There appears to be some difference of opinion as to the best place for the boiler, some choosing the roof of the car, whilst others prefer the platform at one or other end. I think there can be little question that the roof is to be preferred, provided the furnace and boiler can be made sufficiently light, and I think this could be done without great difficulty. The fuel used would probably be petroleum, as this is by far the cheapest, most portable, and most cleanly, and a rotary boiler of the description referred to a few weeks since in the Journal would not require to be more than 18 in. long by 12 in. in diameter to supply ample steam for the propulsion of the car. I give the preference to the rotary boiler, because in addition to its extreme compactness it supplies the steam in a semi-superheated condition, well dried, but not so highly superheated as to be non-lubricating. The reason of this is obvious—the whole cylinder is constantly brought into contact with the flame, and as each portion comes to the top it assists in drying the steam above the water.

With regard to the furnace, it would consist merely of a large series of petroleum burners, so that furnace and boilers as well could readily be contained in a chamber 2 ft. 6 in. by 1 ft. 6 in., and 2 ft. high, and the pipe could be taken down within the car to the little rotary engine fixed upon the axle. Those who would object to have the boiler so far from the engine could use a pair of boilers, 6 in. diameter, instead of the one boiler of larger size. The furnace and boiler could then be placed beneath the floor of the car, and in close proximity to the engine, and by providing automatic feed, &c., the trap covering it need not be opened except at the end of the journey, when the car would be empty. By making the rotary engine of fair strength, a wide band to act as a brake could be passed round, and the stoppage, when necessary, would be almost instantaneous.—*Manchester, Jan. 27.*

H. W. S.

COMPOUND-COMPOUND ENGINES AND VERTICAL AND LONGITUDINAL IRON TUBES AND BOILERS.

SIR,—The Propontis has made several successful voyages up the Mediterranean, steaming at high pressure upwards of 11 knots per hour, upon a consumption of about 17 tons of coal, as contrasted with her previous boilers and 34 tons of coal per 24 hours and 11 knots per hour. This craft is 2083 tons gross, and about 1400 tons net tonnage for cargo capacity, and made the voyage via the Suez Canal from Liverpool to Bombay and back (about 14,000 miles) on a consumption of 1000 tons of coal, reveals a fundamental basis establishing the fact by saving 50 per cent. of coal between the low-pressure and the compound-compound engine accomplished by the performances of the Propontis with iron boilers and iron tubes, hence the practicability attained is incontrovertible.

The difficulty of working with salt water at high pressure of 110 lbs. on the square inch on board the Propontis arises from the oxide of copper eating through the iron tubes just the same as if holes were drilled in them by machinery, thus it is the heated water becoming impregnated with oxide of copper, and the chemical ingredients in the sea water passing through the tubes at high pressure are difficulties only to be surmounted by copper tubes and copper boilers. Although the copper boilers and tubes will, in the first outlay, cost more than iron, the saving of coal, as in the case of the Propontis, and the value of the copper as old material, as compared with iron, will bring about economy not attainable in iron boilers, &c., where sea water has to be heated for high-pressure steam.

Mr. W. H. Dixon has solved practically a question for economy highly advantageous to the steam shipping of the British empire, and he deserves for the enterprise and courage he has shown single-handed to be recouped his loss, either from the steam shipowners of Great Britain or by the British nation, as he has divulged principles that will, to the State-owned ships, be of the most paramount importance in not only a saving in the coals consumed, but which will also enable the ships of the British Navy to keep the sea longer upon a decreased daily consumption of fuel.

JOHN CLARE,
The inventor, patentee, designer, promoter, and upholder of
England's metal, shot and fire proof ships since 1853.

Liverpool, Jan. 26.

CONCRETE FOR BUILDING PURPOSES.

SIR,—Although the experience of ages has proved the strength and durability of concrete as a building material, the use of it for general purposes has hitherto been comparatively limited. Attention has, however, now been directed anew to the subject by the introduction of the inventions of Mr. Thomas Cooke, of Sing Sing, New York, who proposes a new method of pressing concrete into blocks, for the formation of paving and building blocks. The pressure is applied to moulds in a wheel, and in such a manner that there is the least possible wear and tear of machinery, whilst the resulting blocks are very accurate, and free from flaws. The machinery appears rather complicated in its character; but I am assured that it is not liable to get out of order, and that a machine at a lower first cost could not be constructed to do the work equally well. The same invention is said to be equally applicable to the compression of artificial fuel, with but little modification. He would at a single operation combine the materials, compress them into blocks, and deliver the completed blocks from the machine in such a manner as to effect the utmost possible saving of time and hand-labour, and produce the most perfect blocks at the least possible expense.

He employs an improved combination and arrangement of mechanism adapted to heat asphalt and pulverised or granulated stone or other equivalent thereof, conveys the heated stone and heated asphalt to a mixing vessel, and discharges them together thereinto, thoroughly mixes and incorporates them together, conveys the mixed materials to the press, and compresses them into suitable blocks, or, if desirable in any particular case, conveys the completed blocks away to a suitable receptacle, or to the place where they are to be used. The invention certainly appears to be one which would be

worth consideration in England, both for utilising small coal and for manufacturing building blocks.

H. H. D.
Broome-street, New York.

NICKEL MINING IN NORWAY.

SIR,—Being interested in nickel mining in this country, I should be glad if some correspondent would state the address in Belgium of Messrs. Montefiore and Co., who were a short time since referred to in the *Mining Journal* as being buyers of nickel ore, also whether there is any fixed rule for the sale of the ores of nickel—say, from 2 to 4 per cent. metal in the ore. Speiss, I am aware, commands a ready sale, but the place where the ore I refer to is obtained being new, and as yet without smelting-works, the question is whether the raw ore can be profitably returned in the interval. I may add that the district in question is within tolerably easy reach of the Trondhjem Fjord, quite new as a mining field, but the writer's opinion is that the mineral is in the right sort of formation for the metal sought; but as operations are only now about to commence it is not wise to anticipate results. I hope, however, soon to give you further information on the subject, and seeing the grand results at Senjen—a concern taken up by Mr. H. H. Vivian, of Swansea, in 1872—there are great inducements to search for similar mining fields in the extensive, and many of them unexplored, regions of Norway.

Dronheim, Jan. 10.

CONSTANT READER.

DEPRESSED MINING SHARES.

SIR,—At the commencement of a year which promises to be marked by considerable activity and vigour in mining enterprise, it may not be out of place to refer briefly to a few of the mining undertakings which seem to possess the elements of success, although at present their shares, from various causes, are in a greater or less degree depressed in price in the market. Of course, from the very nature of mining (which possesses the attribute of uncertainty more, perhaps, than any other class of enterprise) it is manifestly impossible for anyone, however great his practical knowledge may be, to point to any particular mine and say that its further development will lead to future returns of ore, and dividends for the shareholders who have ventured their money in it, but the reports forwarded from time by the managers at the mine, and the reports submitted by directors to their fellow-proprietors, contain data which enable a rough estimate to be formed respecting the probable chances of future success. Again, apart from what may be called the local data—that is to say, the discoveries and progress made from time to time at a mine—there are certain general considerations which may be taken into account in the endeavour to form an opinion of the prospective value of mining properties; one important point to be looked at is the situation of a mine with regard to adjacent concerns of a similar character; a knowledge of the run of the lodes in the locality is of great assistance in forming a judgment, and there are other considerations which will suggest themselves to the minds of those who take an interest in mining adventures.

Passing, however, from generalities, there is the Chontales Consolidated Mining Company working a Nicaraguan property, of which the late Mr. Nokes (who possessed an intimate and practical acquaintance with gold mining) had a very high opinion. No dividends have yet been paid, and the 2½ fully-paid shares are quoted at from ½ to ¾, but a careful perusal of the periodical reports from the mine leads to the belief that the company possesses an auriferous property of considerable value, and there seems fair reason to hope that, with careful and economical management, the company will one day turn the corner, and be able to present accounts showing a profit which will admit of the payment of a dividend to the holders of the shares. The United Mexican is an old company, with an influential body of shareholders. Since 1864 (when two distributions of 5s. each were made) dividends have been suspended, and the hopes of the shareholders as to the future rest mainly upon a newly-acquired property, which Mr. Furber (whose knowledge of mining in Mexico is greater, probably, than that of any miner living) considers holds out good promise of yielding profitable results. The shares, with 28½ ds. 8d. paid, are now quoted in the market at about 4½, so there is a large margin for improvement in value; and looking at the patience with which the shareholders have borne the deprivation of dividend, and the pluck with which they have worked the new property, it would be particularly pleasing to see this respectable company again in the list of dividend-paying undertakings. The next enterprise to which allusion may with propriety be made is the New Quebrada Company, which is engaged in working extensive mining concessions from the Venezuelan Government. At one time the post of a director of this company was anything but an agreeable one, and there is no doubt that the dissensions and differences of opinion which, till recently, kept cropping up amongst the shareholders considerably delayed the exploration and development of this very promising property. These disputes and contentions are happily things of the past. After the storms have come the calm, and since the board as at present constituted have been in office matters are going on smoothly enough. There seems to be no doubt that the mines contain an abundance of ore, and as soon as the Bolivar Railway, which is being constructed to convey the ore from the mines to the port (and which is far advanced) is finished the delivery of ore can be at once commenced. The fully-paid shares of 5½ are quoted as high as 4½ 5s. to 4½ 10s., so that it is evident the prospective value of the property is pretty well appreciated by those who are probably best qualified to judge.

The Tolima Mining Company, which is not quoted in the Official List, was formed in 1871. Its progress has been slow, although, perhaps, not more so than might be expected looking at the very considerable difficulties which had to be encountered. In the first year there was a deficit on the working, which was covered by the net revenues of the years 1872-73, and for 1873-74 a profit was shown, but, waiting the realisation of the ore, the payment of the 10 per cent. preference dividend is postponed for a short time.

From America to Russia is a long leap, but as mining enterprise in the northern countries of Europe has attracted a large share of attention of late years, a brief reference to the Russia Copper Company may not be out of place, more especially as it may claim a place in the catalogue of companies which seem to possess the essentials of future prosperity. The property of the company is enormous, extending over 447,375 acres, comprising copper mines, smelting works, pasture and corn lands, and forests, and at the time the property was purchased by the company it was regarded as exceedingly valuable; up to the present time, however, owing to the difficulty of managing a company at so great a distance, and of organising and administering the affairs of such a gigantic concern, the accounts have shown a balance on the wrong side, but there are reasonable grounds for anticipating more favourable results in future. The 10½ fully-paid shares are worth about 3½ in the market.

The General Mining Association has just passed its jubilee year, having been founded in 1825; its property is situated in Nova Scotia, and for many years dividends were paid to the proprietors, but there was a turn in the wheel of fortune, and no dividend has been paid since 1873; this is a company which may fairly be looked upon as likely to again become dividend-paying. The 10½ shares, with 9½ paid, are quoted at the rather wide price of from 4½ to 6½.

Another company to which reference may properly be made is the Frontino and Bolivia, which possesses a gold property in South America, and, judging from the most reliable reports which can be obtained, there seems a probability of the mine yielding returns. A new company has been formed to take over the Frontino Mines, with the view of working them more efficiently.

The Eberhardt and Aurora Mining Company, after vicissitudes of fortune and almost unprecedented fluctuations in the prices of its shares, may now be looked upon as having fairly emerged from its difficulties, with an excellent prospect of "a good time coming." With a thoroughly practical chairman and board of directors, and a reliable manager at the mine, the company has been dragged from the state of almost utter ruin into which at one time it appeared to have sunk, and the weekly returns from the mine show a fair profit on the working. About twelve months after the formation of the company the 10½ shares were run up as high as 40½, but they afterwards went to a heavy discount, as was the case with the shares of most of the other large American mines which were started at the

same time. The 10% fully-paid shares are now quoted at about 9%, which may, probably, be looked upon as about representing what the shares are worth.

The South Aurora Company (started in the same year as the Eberhardt and Aurora) paid a dividend of 12s. 2d. per share in 1871, since which the dividends, with the exception of 2s. per share in November, 1873, have been nil. It is difficult to judge from the reports whether or not there is a future before the company.

The Panulicillo Copper Company has, since 1864, been working a mineral property in Chili; since 1869 no dividend has been paid, and two or three years ago the company seemed in anything but a promising position, not so much from any want of ore in the mine, but from the comparatively low price which copper was fetching in the market. The last report of the directors was, however, of a decidedly favourable character, and the resumption of dividends may be looked for at no distant date. The 4s. shares, fully paid, are quoted at 1 to 1½.

The Javali Company, which owns a gold-bearing tract of land in Nicaragua, may be classed amongst the mines which hold out a tolerably fair prospect of making profits; it is true the shareholders have had a long time to wait without seeing any return upon their investments, and the monthly reports from the mine vary very considerably; still small profits are being shown, and the debit balance which has existed for some time past has been considerably reduced.

There is another gold mining company of which mention must be made, a company which at one time attracted a great deal of attention, and which was the pioneer of several similar undertakings, nearly all of which have, unfortunately, gone to the wall, or are in a moribund condition; the company to which we refer is the Don Pedro North del Rey (more generally known by the abbreviated title of the Don Pedro). For several half-years this company paid handsome dividends, and its excellencies were trumpeted forth, and it was held up as a kind of model of what all gold mining companies ought to aspire to become, but a day came when doubts began to be raised whether the gold-producing capabilities of the mine had not been much over-rated, and as time went on those doubts became certainties. The dividends were discontinued, and at present there is a considerable debit balance against the mine, and the monthly returns, although showing a considerable produce of gold, have not been sufficient to enable the directors to place the balance on the other side. Nevertheless, there are many people who believe that the company may again work itself into a dividend-paying condition.

The Chicago Silver Mining Company is a young concern, having only been in existence about two years and a half; dividends were paid for a short time, but there has been no distribution of profit since May of last year. There seems a chance of better results being obtained from future working. The above list comprises some of the mines which have attracted, and continue to attract, a considerable amount of public attention. In a brief notice like the present space will not permit of allusion to many other mining companies which may be looked upon as possessing, in a greater or less degree, a chance of emerging from their present condition of depression; for instance, mention might be made of the Colorado Terrible (which has till recently been a dividend-paying concern), the Cesena Sulphur, the Cedar Creek, and the Birdseye Creek amongst foreign mines; and amongst English mines, the Whitehaven Iron (which has hitherto been prevented from making returns, owing to the non-completion of the railway to carry the ore from the mine), the Native Iron Ore Company, the Great Western Colliery (which at one time paid dividends of over 50 per cent., but at present is sinking to the steam coal, during which operation returns are suspended), the Cardiff and Swansea Smokeless Steam Coal Company, and many others, especially several which are scarcely known beyond the circle of adventurers more immediately interested.

There can be no doubt that mining enterprise, notwithstanding the disappointing results of many large English and foreign mines, is beginning to attract more and more the attention of investors. No doubt the risks are considerable, but on the other hand the profits are often enormous. Most of the mining undertakings which are now making good returns have had dark times through which they have had to struggle, and it was only through the pluck and perseverance of the adventurers that they have been brought into a dividend-paying condition. Therefore the low price at which many mining shares are quoted is, in many cases, no criterion of their intrinsic value, because there is always to be taken into consideration the wide margin for improvement in the future which exists in connection with so many mining undertakings. Probably at a future day I may recur to this subject.

Old Broad-street, Jan. 25.

MINING ENTERPRISE—LORDS' DUES.

SIR,—Fraught with weighty considerations are the warnings of your able correspondent, Mr. William Teague. Of the "men of Cornwall" few in our day have had more varied or more successful experience, nor would it be easy to find one better qualified to form a sound opinion as to the most ready and sure means to ameliorate the existing exigencies of Cornish mining. Rightly, indeed, does Mr. Teague combat the statement that the "depth of Cornish mines will not be their extinction," rather will it be the shallowness of the "pound of flesh" policy adopted by the "hereditary lords." In those "ancient classic periods" referred to by your correspondent, and in much more modern times, lords and adventurers equally shared the risk and outlay of a mine's development, and until a similar principle shall be re-established we may look in vain for those millennial days so poetically foreshadowed, "when the Cornish banner 'One and All' will again float on prosperous breezes."

An adjustment of the influences operating on this great enterprise can only be brought about by concessions from those who have the most permanent interest in it. How utterly short-sighted the almost prohibitive policy now so generally and justly complained of! Shareholders may go on year after year profitlessly expending their capital upon a mine, yet—Shylock incarnate—the modern "hereditary lord" secures to himself the money value of his dues upon ore, the extraction of which has already cost more than it repays.

The Gawton Copper Mining Company (the meeting of which was reported in last week's Journal) is only one of numberless other instances. Here a body of shareholders have been expending large sums of money for more than 20 years; apart from the merchants; the only pecuniary advantage resulting has passed into the pockets of the lord. Surely wonder need not be expressed that the shareholders should after this long interval of time consider how best to work the mine to their immediate advantage.

Scarcely happy was Mr. Teague's statement that Cornish mining is well high in a beleaguered state, and hostile hosts assail it. Is it not more true that the *causa belli* is rather within the citadel? Are not the beleaguers, failing to attain the equitable terms demanded, finding more satisfactory employment elsewhere? "Hostile hosts" no longer assail, but the citadel bewails because, like those of old, "they do consume their own vitals?" Hostility is a "thing of the past." If "tact and force are required in its interest" it must proceed from within the walls of the fast falling fortress. The situation is admittedly perilous, as the fascination of foreign adventure is the competitor. Commendably does Mr. Teague call upon the lords of Cornwall to "maintain unsullied their ancient escutcheon," but rather should he demand its re-embellishment. The watchword should really be "One and All."

If the lords of Cornwall, from their education, presumably feel the full weight of the importance which the ancient lineage of Cornish tin mining carries, how strangely, indeed, do present circumstances contrast therewith. If education be held responsible for selfish perversity, of what avail can be Mr. Teague's appeal to those "hereditary lords" to review the "commercial archives that trail back to the earliest times?" Primarily should the lords remove the great obstacle to the progress of Cornish mining, otherwise the emanation cannot be arrested. Times and conditions are widely different to those even within the recollection of almost the youngest of us. Cornwall no longer stands pre-eminent as a mining centre, it no more commands and regulates the tin and copper markets—it is now nothing more nor less than a moderate supplier in a market hitherto its own, but becoming daily more universal. If, then, self-interest dictated a more liberal policy in the past, how much more

imperative does it become now? Cornwall must inevitably get from bad to worse without the aid of extra-capital. With few exceptions, the miners of Cornwall do not employ their own means in the development of their own mines. Let the lords be up and doing, or the power of recuperation will pass away beyond even the hope of recovery.—Jan. 26.

OBSERVER.

METALLIFEROUS MINES, AND LORDS' DUES.

SIR,—Under the barren hills which generations of lords have permitted to lay untried and hidden the necessitous miner has searched and discovered hidden riches which have enhanced and made valuable the surface, brought a population to reside, increased the value of land for building and farming purposes. Who has derived the profit, a profit unsought by him, untried and undreamt of? Acres after acres have been enclosed by the frugal and industrious miner after his day's work was done until few barren acres are left within the reach of his cottage. Acres which have been cleared and fenced have remained but to benefit the labourer but few years ere his course was run, and the land became the lord's again to let for a term of lives. The question now pressing for solution is how long will the miner have a home in his native country if the deep mines suspend operations and the poor ones shut up?

How long will the miners' cottages be occupied, the farmers' produce be required, or the grocers' and drapers' goods be in request? What are the lords of the mines doing to assist the adventurers? While the richest mines are struggling what dues are given up? Whose interest is it more than the lords that these mines shall continue? for if once full of water full for ever. I have just been perusing the terms of lease of a lead mine where the shareholders have agreed to pay 2 per cent. upon two-thirds of the produce of the mine, which amounts to about 120 tons of lead per month, or about 3s. per ton of lead ore instead of 20s., as paid by many Cornish mines. The moment has arrived when the lords should show by their acts they are awake to the necessity of assisting mine adventurers ere it be too late.

A WELL-WISHER TO THE COUNTY.

Redruth, Jan. 25.

THE NEW MINERALOGICAL SOCIETY.

SIR—I am glad to see it announced that it has been arranged to hold the first general meeting of the Mineralogical Society of Great Britain and Ireland, for the election of officers, &c., at the rooms of the Scientific Club, Saville-row, on Tuesday, Feb. 3, and that the chair will be taken at noon by Mr. H. C. Sorby, F.R.S. This announcement is immensely gratifying to me, inasmuch as it was thought by some of my friends that my rough mode of showing, in the Journal and elsewhere, the necessity for some such society would fail in the enlistment of sympathisers. Happily, it has not so proved, for more than a century of workers are enrolled already, and when I see amongst them such names as Ansted, Church, Crookes, Davies, Geikie, Greg, Houghton, Huddle, Jones, Nicol, and I Sorby, I fancy that I see the beginning of the end of "Doubtful Minerals" and "Dual Mineral Nomenclature."

Yours, stickily as ever, T. A. R.

Liverpool, Jan. 24.

GOLD IN WALES—No. XVI.

DOLGELLEY DISTRICT—TYN-Y-GROES SECTION (continued).

BERTHLLWYDD AND CEFN COCH MINES.—These mining sets extend for about 3 miles, north and south, at a distance of about a mile westward of the Dolgelley and Tyn-y-bwlch turnpike road, not far from Tyn-y-groes Hotel. These peculiar mining properties have enjoyed a great amount of notoriety under the encroaching and insinuating title of "The Welsh Gold Mines," and as the mining particulars thereof are to a great extent treated of by other writers in connection, for obvious reasons I prefer to do the same. Once upon a time the country was startled from its usual propriety by circulars containing the following announcements:—

"THE WELSH GOLD MINES.—Public attention is now awakened to the growing importance of gold mining in Wales, and to the fact that a new element of national wealth is rapidly springing up in that direction. The district is also talked of as 'New California,' and the number of pilgrims to this new shrine of Mammon is greatly on the increase. Under these circumstances, a few words on two of the principal Welsh gold enterprises may not be uninteresting. They were both formed without advertisement or publicity of any sort, and without recourse to the Stock Exchange, and are both under the management of Mr. Robert Gillman, one of the largest shareholders in both companies, and one of the most intelligent and honourable administrators in the kingdom. The mines are situated in the picturesque neighbourhood of Dolgelley, North Wales, and are worked by Mr. Robert Gillman."

"THE VIGRA AND CLOGAU COPPER MINES.—The Vignra and Clogau Mines, situated in the parish of St. John, Denbighshire, are worked by Mr. Robert Gillman, one of the largest shareholders in both companies, and one of the most intelligent and honourable administrators in the kingdom. The mines are situated in the picturesque neighbourhood of Dolgelley, North Wales, and are worked by Mr. Robert Gillman. The Vignra and Clogau Mines are worked by Mr. Robert Gillman, one of the largest shareholders in both companies, and one of the most intelligent and honourable administrators in the kingdom. The mines are situated in the picturesque neighbourhood of Dolgelley, North Wales, and are worked by Mr. Robert Gillman. The Vignra and Clogau Mines are worked by Mr. Robert Gillman, one of the largest shareholders in both companies, and one of the most intelligent and honourable administrators in the kingdom. 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would be second only to the Van in that district. I believe that the Van Consols also will, if persevered with, turn out a valuable property. All that are wanted to make those mines productive are capital and applied mining skill.

Carnarvon, Jan. 27.

VALUABLE DISCOVERY OF LEAD IN YORKSHIRE.

SIR.—Being in the neighbourhood of Appletreewick, a few miles north-west of Skipton, on the 19th inst., I was agreeably surprised to see a number of carts conveying lead ore from a discovery made recently in new ground near the old Appletreewick Mine to the smelting works some miles distant. On making enquiries as to the nature of the discovery I was informed that there are from seven to ten points in operation, from each of which a large amount of lead ore is brought daily to the surface. Some of these points are said to be exceedingly rich, and worth as much as 100*l.* per fathom, and the deepest workings in these rich veins are only from 20 yards to 30 yards below the surface. If only one-half be true of what is said it must be a very rich discovery, for besides a good number of tons already taken away to be smelted, I was told that 40 tons of washed lead were then on the premises ready for removal, and an estimate of 140 tons more was lying on the surface in an unwashed state. Most astonishing, however, was the fact that no one could give me any information as to the number or marketable value of the shares. What would be said of such a discovery had it been made in the Welsh, Cornwall, or Devonshire mining districts? The place would have been besieged by share buyers and share sellers, but in quiet Appletreewick there is a mine of incalculable value, which seems only to be known by the people in the immediate neighbourhood, and, of course, by its lucky shareholders.

I was further informed that the ground adjoining that in which these discoveries have been made is quite as rich, if not richer, than its neighbour, there being more east and west and cross veins running through it. The principals, however, in this affair seem to lack good judgment, as I am told upon good authority that the workmen have discontinued doing similar work to their neighbours (which if continued must have been followed by the same good results)—driving a deep level which would take almost a lifetime to accomplish into the face of a great hard limestone scar. This I am aware is a characteristic feature in the notions of the mining fraternity of Yorkshire, and it is thoroughly believed by many of them that it is impossible to have a good mine without first spending thousands of pounds in driving a deep day horse level.

The Old Craven Moor Mine, which I have for many years known, is, I am glad to say, getting into active life again, and I am told is likely to do well. I am also informed that other mines in the district are looking very favourable.

I should have remarked that the 200 tons of lead ore said to have been raised from the Appletreewick Mine discoveries up to the 19th inst. is the yield of a little over two months' working, and the work of a very few hands. Going on as it is so quietly and so successfully is proof positive that it is not intended for the stockbrokers. The Appletreewick district will prove a rich mining field.

Leeds, Jan. 25. A WELL-WISHER TO LEGITIMATE MINING.

SEPARATION OF MINERALS.

SIR.—Will you kindly allow me once more to make a few remarks on the above subject through the columns of your valuable Journal. Mr. Joseph Jewell, in his letter to the Journal a short time since, said he should not have taken any notice of my first letter on this subject (separation of minerals) had I not mentioned Barrow and Butson Mine. Your readers will remember my reply to the letter of "Correspondent" in reference to that mine of Dec. 30. Query—Would Mr. Joseph Jewell have taken any notice if I had not said something in reference to "theoretical, book-taught" men, and of a class of men interfering with practical dressers; or did the cap fit him when I made reference to parties getting into good situations, with high salaries, not through merit, but by heirship? I would ask, Mr. Editor, what on earth can a man know about lead, blende, &c., dressing, who was born in a tin and copper district, employed at the writing-desk until manhood, then working underground a little while on tribute in tin, then to get in agent No. 2 over underground work, and not a lead lode in the district that has ever been brought to light? All competent dressers will agree with me that for a man to thoroughly understand the cleaning of ores he must work on the floors from a very small boy.

Mr. Joseph Jewell says it appears that I am of a class of men ready to tell others what to do when there is no possibility of their doing a similar thing. To convince your readers that this is not the case, I will give Mr. Joseph Jewell a few facts (and they are stubborn things). I would refer him to another mine, mentioned in my first letter—Cargoll, Newlyn East. For nine years I was one of the dressers at that mine. We returned about 60 tons of lead per month, from 17*l.* to 18*l.* per ton; 20 tons of copper per quarter, best about 14*l.* per ton; and about 100 tons of blende per quarter, best 5*l.*, seconds 3*l.* per ton; and scores of tons of mundaic every year. And, to further prove that the dressing was effectual, let me add that there is an engine working on the mine, and water running between the burrows, and every facility for dressing them. There are men who worked for years on the floors now employed on farms, and breaking stones on the roads, simply because the burrows will not pay for re-dressing at any price.

To show that Mr. Joseph Jewell has not heard everything, I beg to state that there is a combination of minerals in Treburtz—of course, not to the extent that it is in the aforesaid mines. We sampled a parcel of copper ore some time ago, also blende, and we have just sent off a cargo of iron ore. Mr. Joseph Jewell doubts if I could find one boy that could dress mixed ores. Shall I surprise him by saying that at Cargoll lead, copper, blende, and mundaic were all separated and dressed by boys, and not many miles from Truro a mine making very large returns in lead and blende is employing scores about the same thing. Of course, Mr. Editor, I expect those "lettered gentlemen" to pounce on me as so many eagles, but all "practical" men know that I am not far wrong, and common sense tells us who the men are that are able to do it.

St. Teuth, Cornwall.

THOMAS ELLERY.

WHEAL GRENVILLE.

SIR.—Matters do not appear to be going on in a very flourishing way at this mine since the late changes in the management. The tin returns have fallen off to a considerable extent, notwithstanding an improvement in the 160 west, and in spite of Mr. Lane's assertion, when he commenced his agitation against the former secretary, that it only required a change of London offices, with economic and vigorous working at the mine, to make the property a paying one at once. At the last general meeting the committee estimated the expenditure for the next two months at 900*l.* per month, and the returns of tin at 600*l.* per month. The first month's cost immediately after this estimate is likely to be over 1050*l.*, and the tin will probably be about 450*l.*, showing a loss of 600*l.* on the month's workings, or nearly double what it was under the old management. So much for the committee's estimate and "the exercise of vigorous and economic management" they so strongly recommended in their report to the adventurers at last meeting. This loss appears certain to be increased in the future under the present system of working. The shares, however, are moving up, and this, may be, is all that certain parties may care about, for certain purposes, which may in time become apparent. Everybody down here is surprised how the majority of the adventurers could suffer themselves to be so misled by Mr. Lane's charges against the late management as to commit the folly of placing the interests of the company entirely in his hands, giving him the power to discharge the secretary and other officials who had been connected with the mine for years, and who were, therefore, the best judges as to the way in which the mine could be most advantageously worked. I can tell you, Mr. Editor, that no one down here has any confidence in the present London management, but not a man that does not say the old parties have been most wrongfully treated, and that the adventurers will before long find to their cost the mistake they have made in handing the control of their affairs over to Mr. Lane. As an old miner said to

me in a joking way the other day—"He's Mr. Lane now, but he and the adventurers who confide in his management will be *Lean* through Wheal Grenville before they are many months older." If the company have done it all on the score of economy they will find that system is not always the wisest to pursue in mine management, and that it is better to give great salaries to well-trying and experienced men who have your interest at heart than to have a cheap and incompetent executive to lead to a total wreck of your property. I shall write you again shortly as to how things are going on.—*Camborne, Jan. 25.* F. L. A. T. RODDA.

LLANRWST LEAD MINE.

SIR.—I will thank you to allow me to correct an error which somehow crept into my report of this mine as published in last week's Journal. In respect of the current lode at the adit, I gave its size as 4½ ft., producing 2½ tons of lead ore per fathom. "As good wine needs no bush," this correction had better be made.

Jan. 26.

R. KNAPP.

THE CHAPEL HOUSE COLLIERY.

SIR.—The last time I addressed you—a considerable while since—the subject of my communication was the Chapel House Colliery Company, which has continued to be prosperous and profitable, and is, all things considered, one of the most important coal-raising properties in that part of the North of England; and as coal is the great mainspring of all our manufacturing industry, I would again call your attention, and through you that of your readers, to it. Without a plentiful supply of coal at reasonable cost, but affording a fair profit to the coalmaster, our iron trade especially must languish. Furnaces will be blown out, and the cheerful ring of the hammer and the anvil be silent. The production of our textile fabrics is so dependent upon the fuel by which the steam which moves the machinery is generated that the vast cotton districts, those of broadcloths, worsted, and silk, as well as the cutlery shops of Sheffield and the metallurgical establishments of Birmingham, would cease to be productive. As steam is the great motive power on the railroad and on the ocean, we may be said to travel by coal, and our carrying trade subsists by it. Whatever be the importance, therefore, of our metalliferous mines our coal fields are still more valuable, initiating and maintaining all our industries. The discovery of a good mine of coal, its working, and successful management is, therefore, a welcome item of intelligence to the political economist, the statesman, the shipowner, the manufacturer, the mechanic, and the labourer, as well as to the miner and investor. Such is Chapel House, originally a good find, worked successfully, managed economically, and with indubitable prosperity before it.

The mine is situated in great wealth-making Lancashire, where, as in the case of Barrow in Furness towns rise up thriving, populous, and politically powerful, not only from the presence of the cotton manufacture, but from the vicinity of coal and iron, especially the former. Chapel House Colliery is situated near Ormskirk, in the county of Lancaster, and has easy railway convenience in every direction with the great mercantile centre Manchester, the large producing districts of Bolton, Bury, Blackburn, Darwen, Preston, Wigan, &c., and the ports of Liverpool, Fleetwood, and Barrow, and the district of which it is the immediate centre is immensely coal consuming, able to take the whole yield at the pit's mouth. The situation of these works can hardly, therefore, be surpassed anywhere. The production is very great, and the prospective production is 1000 tons per day. There are known to be 11 seams in Skelmersdale, where the pits are, with a total average thickness of 37 ft. of workable coal. The coal is much liked at Liverpool, only 14 miles distant, and where the company has offices. The Dublin demand at Liverpool is enormous, and the company has there established a large wharf.

At the colliery there is a large plant, consisting of the necessary pits, machinery, stagings, stores, 325 wagons, 28 flats or lighters, 3 schooners, and, in fine, everything essential to a great trade. It is very important to observe that the veins are easily worked, there being very little water, so that no pumping machinery is required. There is neither gas nor noxious vapours, so that the men work with naked candles. All description of labour is easily obtainable from the humblest pitman to the skilful engineer. The long experience of Lancashire in collieries and factories has provided an abundant supply of able and skilled labour in every department. The importance of our foreign trade in coal and iron with which it is more immediately allied may be seen by a glance of comparison with the cotton and woolen trades.

The export of coal and iron bears to the export of cotton manufactures the proportion of about four to seven. The export of woolen manufactures bears the proportion to coal and iron of only three to five, this including the export of British wool. So that the woolen cloth exports with British wool, although counted one of the great staples of the kingdom, is inferior to the united exports of coal and iron, being only about three-fifths the amount.

I trust, Sir, that our tin, copper, lead, and iron mines may all flourish, for mining is the backbone of England; and as Mr. D'Aubigne remarked, "England under-ground is even more wonderful than England over-ground." But I also hope that the classes of investors who at present confine their ventures to metalliferous property will give a share of their attention to what in contradistinction are called "mineral properties;" and if so, that of Chapel House Colliery is inscribed high on the roll of such as deserve it.

Royal Exchange Buildings, City.

GEORGE BUDGE.

THE EMMA MINE.

SIR.—Although not connected in any way with the Emma Mine, I have taken an interest in the discussions and opinions of which it has from time to time been the subject; but so far as the reports and correspondence that have appeared in Scotch papers are concerned, I have seen no indication of the true nature of the mine. It is a fact, I presume, that it has yielded a certain amount of metallic ore, while it is agreed on all hands that no well-defined lode or rake vein makes its appearance. This seems to point to the conclusion that it is what is called a "pipe" mine. A rake vein, or lode, occupies a crevice of the earth's crust in a vertical position, or nearly so, and ranges along the surface in some cases to a great distance, being rich at intervals.

There are few examples of lodes being distinctly traceable for many miles in Great Britain, but in South America they may be followed in one continuous fracture to a great distance—in one case at least 90 miles. Some years ago, on examining the copper and lead mines on Lochyvenish, I found them regular rake veins, one crossing the mouth of Loch Gilp, and making its appearance on both sides. It was opened at Castleton, and yielded some fine specimens of yellow and peacock ore, but on the Ardaraish side mundaic was more abundant than the more precious metals. The matrix or veinstone was white quartz, which predominated to such an extent that the metals could not be worked to profit. On Inverlorn there were many quartz veins that contained no copper or lead at all. A pipe is an irregular mass, accumulates, sometimes coincident with the plane of stratification, but not unfrequently assuming the appearance of a rake vein in a position either vertical or inclined. When a pipe is interbedded with the rock, like a stratum or layer, it is called a "flat," and seems to be merely a portion of a rake vein diverging from the principal mass.

The Lochyvenish Copper Mine is a good illustration of pipes. The containing rock there is a hard whinstone, so hard that on one pipe being worked out driving in search of another was an expensive matter, and it will be remembered how fluctuating the shares of that mine were—up when a pipe was reached, and down when it was worked out. The Emma, I have no doubt, is a pipe mine. The rock is a primary limestone, hard enough, I believe, as some primary limestones are. It cannot be denied that pipe mining is very uncertain, and, with solid whin to drive in for copper or lead, shareholders could hardly expect to make fortunes, but a rich deposit of silver ore, although only occasionally met with, would furnish more abundant resources, and ultimately a rake vein might reward the energy and enterprise of the company. I make these few remarks merely with the view of indicating the true nature of the mine in question, and without the remotest intention of influencing the shareholders, none of whom I know. THOMAS STRUTHERS.

CORSICAN MINES.

SIR.—I observe in the Journal of Jan. 15 it is stated—15*l.* per fathom for the lode at the Lama Mine. It should have been 75*l.* per fathom. Olmeta Copper Mine has very greatly improved since my last.

Lancaster, Jan. 26.

A SHAREHOLDER.

[For remainder of Original Correspondence, see to-day's Journal.]

CORNISH PUMPING ENGINES.—The number of pumping-engines, reported for December is 17. They have consumed 2076 tons of coal, and lifted 15,600,000 tons of water 10 fms. high. The average duty of the whole is, therefore, 50,800,000 lbs., lifted 1 ft. high, by the consumption of 112 lbs. of coal. The following engines have exceeded the average duty:—

Crenver and Wheal Abraham—Sturt's 90 in.	Millions	59.7
Ditto ditto —Pelly's 80 in.		57.7
Ditto ditto —Willyams's 70 in.		75.4
Dolcoath—85 in.		59.4
West Raset—Thomas's 60 in.		54.5
West Tolgus—Richard's 70 in.		52.4
West Wheal Seton—Harvey's 85 in.		57.2

SIR.—At his residence at Camborne, on Jan. 27, in his 61st year, Capt. JAMES ROWE, manager of Medlyn Moor and other mines. Deceased was well known, and enjoyed a deservedly high reputation in the mining world, and his great experience and knowledge of practical mining (extending over a period of nearly half a century), combined with his unvarying straightforwardness and integrity, led to his frequent selection for important inspections of mineral properties in various parts of the world. Capt. Rowe commenced his career as mine agent at Dolcoath, then under the late Capt. Charles Thomas's management, and there were few who were better acquainted with, or gave a more interesting history of, that famous old adit, especially of the important and critical period of its transition from a copper to a tin mine, than the subject of our notice. Capt. Rowe was for some years manager of Wheal Ury, North Jane, Garlinda, &c., and was up to the time of his death consulting agent at Trampet Consols. In private life his unblemished character and sterling qualities commanded the respect and esteem of all who knew him, whether as a relative, neighbour, or friend.

LIGHT MACHINERY MOTOR.—According to the invention of Mr. M. E. WEST, of Limehouse, a drum on the shaft of the motor communicates motion to a disc on the sewing machine shaft by an intermediate drum, which is mounted on a spindle fitted in movable bearings beneath the table, and arranged to be thrown in and out of gear by a treadle and spring. A brake is also provided for arresting the sewing machine instantly.

Meetings of Public Companies.

MINING COMPANY OF IRELAND.

The half-yearly meeting of shareholders was held at Dublin, on Jan. 20, to receive the report and accounts, and to sanction the sale, to Mr. Thos. Gray, of Waterford, for 1200*l.*, of Corriganville mills and lands, in the country of Waterford.—Mr. P. B. DARCY in the chair.

Mr. WILLIAM HAROLD (the secretary) read the notice convening the meeting, and the report and accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report, said that the Knockmahon Copper Mines had caused the board considerable anxiety for the last few years. In fact, since 1872, when they realised a profit of 3000*l.*, they had been obliged to work those mines at a loss as the result of unforeseen and unavoidable circumstances—the poor yield of the mines, together with the depression in the market. However, without going into the history of mining operations, he believed the abandonment of the concern would be most calamitous. The directors assembled the managers of their various establishments together at Knockmahon, and after investigation they all concurred that it was more than probable a large deposit of ore would yet be found. Having regard to the large extent of the unexplored ground, the board were bound to carry on the explorations. If they abandoned the Knockmahon doubtless other adventurers would take it up, and likely in six months to succeed. The deliberate opinion of the directors was that they must continue working Knockmahon. Next the report dealt with their collieries, in which a considerable improvement had been made. It might be asked through whence the improvement, when the output was less than half year than last. They should remember that on a previous occasion he stated that what they wanted was to reduce their stocks, and they had done so by 4000 or 5000 tons of culm in the half-year. It was next to impossible for them to develop the collieries to their full extent until they had obtained railway accommodation. They had had an interview with the directors of the Great Southern and Western Railway Company to obtain a reduction in the scale of charges on the carriage of coal; but while they reduced the rates they did not make a reduction to the extent required. However, he hoped the new line between Thurles and Ommel would shortly be opened, in which, at Laffan's Bridge, there would be a branch line into their collieries, when they would be able to develop their property to the fullest extent. The Duhalloo Collieries afforded a small profit, and they expect an increase next half year. In the Laganum Lead Mines, county Wicklow, the raisings had been about the same as last half year, but they had instructed the manager not to raise beyond a certain amount. If they could realise 3000*l.* or 4000*l.* a year, keeping up the profits, that ought to suffice, so that they might have a reserve. In fact, to use a mining expression, they could remove lead for the next three years existing all operations. The returns of ore became so large the difficulty was how to dress it, and their manager had invented a mode whereby two or three boys were able to do as much as nine men did before. Their smelting works at Ballycross were being made available to the fullest extent. They had lately added a pipe press, which made every description of gas-pipe; and they had increased their sales by 7000*l.* or 8000*l.*, having extended their market to England and Scotland, where they would find sale for almost all they could produce. A passing observation about the accounts, since his connection with the company they had never been in the same financial position they were in now; for he had never known the company able to pay a dividend out of money lying idle in the bank, while now they had 4000*l.* odd to their credit. Taking that as a criterion of prosperity, it was manifest that matters were going on rightly. At the same time the liabilities of the company had been reduced some 5000*l.* He concluded by formally moving that the report be received and adopted.

Mr. EDWARD FOX seconded the motion, and expressed satisfaction at seeing a prospect of better times for the company, in the direction of which intelligence, prudence, and perseverance were combined. As a reward for their labours he was glad to see that the report indicated larger dividends in future.

The proposition to obtain outside engineering advice having been rejected, Mr. DENIS O'KEARNEY gave statistics showing that since 1858 there has been a considerable loss on the working of Knockmahon. In that year the output of copper was 2587 tons, while the output of the last half year was only 945. But having witnessed greater losses in mining operations, attended with ultimate profits, he still hoped for the best. From Laganum they realised a profit of 7000*l.* a year, and it had in former years been worked at a severe loss. Vicissitudes in mining operations were inevitable. However, it was satisfactory and assuring to see the directors adding considerably to their own shares every half year, thereby proving their confidence in the prosperity of the company. The Slieveagh Collieries he knew very well, as he had long resided in the neighbourhood, and he was able to say they were a splendid property, and would greatly increase the earnings of the company when the railway was opened between Thurles and Ommel, which would, he expected, take place in six months hence.

The report was then unanimously adopted; a dividend of 5 per cent., free of income tax, was declared.—Sir Robert Kane, Mr. F. B. Darcy, and Mr. R. Martin were re-elected directors, and Messrs. E. Fottrell and Henry Guinness were appointed auditors.

The CHAIRMAN moved the sanction of the shareholders to the sale of Corriganville mill, and 3 acres of land attached, in the county of Waterford—which had been acquired to secure a watercourse—to Mr. Thos. Gray, or such other person as the directors think fit, for 1200*l.*—Mr. FOTTRELL seconded the motion, which was agreed to.

The usual vote of thanks to the Chairman terminated the proceedings.

DENBIGHSHIRE CONSOLIDATED LEAD MINING COMPANY.

A general meeting of shareholders was held at the offices, Great St. Helen's, on Wednesday.—Mr. F. RUDALL in the chair.

Mr. E. J. BARTLETT (the secretary) read the notice convening the meeting. The report of the directors and balance-sheet were taken as read.

The report of the managers was read, as follows:—

Jan. 19.—We beg to hand you our report of progress made since October. On surface we have made no alteration, nothing being required.—Phoenix Engine shaft: We have extended the 112 yards level east 12 yards, through very hard ground, so much so that it was almost impossible for ore to form in quantities in such ground. At the same time we do not think we drove a single foot in this distance without meeting with a little ore, though not in sufficient quantity to value. During the last month we met with a favourable change of ground, and very fair progress was made. We are now approaching the spot where both ourselves and the whole country expect we shall find abundance of lead. The task has been a tedious one to arrive here, but we are very confident now—looking at the favourable change which has taken place in the ground—that the results so long looked for will be realised. (Those who know the sett will understand us better when we explain that the forebrest is now many fathoms over the hill in front of the office.) The new lode referred to in our last report we have been unable to do anything at since last meeting, and progress throughout the mine has been very greatly interfered with during the months of November and December by the very heavy floods we had to contend with.—Quaker Shaft: The 112 Yards Level West, Parry's Lode: We have opened on the course of this lode since our last report 15 yards, and not one inch of ground have we gone through in which ore has not been found. The ground is everything that can possibly be desired, and we have now arrived at a point where we should expect to meet with the course of ore left at Parry's shaft, but it often happens that hard bars of ground form in front of runs or courses of ore, and cause the lode to be somewhat irregular for short distances, the result of which is that the runs of lead throw back, and consequently cannot at all times be depended upon so as to enable one to calculate correctly the true point where they will be met with. There is one thing certain, that such a powerful course of ore as that we left in the dump below the 40 at Parry's could not die out in the short distance between where we now are and where we left it. In the present end the lode is fully 3 ft. wide, composed of spar and small specks of ore.

North Cross-out: This driving is still in very hard ground. Notes yet having intersected either of the lodes proved in the 66 yard level west, we would strongly recommend you to continue this driving, for as you extend it in the present direction it must cut through every lode known to exist in the Colomendy Park. In the 112 yard level west nothing much has been done since our first intersection with Parry's lode; we left off in very promising ground, and it is well worthy of a further trial.—Junction Shaft: Nothing has been done here since your last general meeting. It is a very important point, and should by all means be sunk down to the 112 west. You could then sink below the 112 west, and on Parry's lode, which would prove the ore passed over in driving in Parry's level. It often strikes one that there must be abundance of lead ore below, in the 112 west. We have nothing more to add. We both deeply regret that success has not followed our exertions in endeavouring to bring the mine into that position which would have handsomely repaid you for the kind support which you have so honourably given us; but we are still confident if that support is continued for only a short time longer our hopes will be fully realised, and you will be repaid tenfold for the expenditure.—JOHN PARRY, JOHN EDWARDS.

The CHAIRMAN said the directors were present to answer any question which might arise, or give any explanation with respect to the mine. He had himself been suffering for some time past, and had not had the opportunity of calling at the office so frequently as he had been accustomed to, but at the same time his interest in the mine had not ceased, and he should hope to give greater attention to the matters in hand. The shareholders had heard the report of Capt. Pryor, in whom the directors had great confidence, and who was a man of energy, and would, no doubt, bring the mine into a paying condition. The secretary had recently visited the mine, and would be happy to give any information. He then moved that the report and balance-sheet be received and adopted.

Mr. E. J. BARTLETT said that in the present statement they had not gone into the profit and loss account, but the development works upon which the expenditure had been incurred were regarded as an asset, while the London expenses, which were for a long period, had been principally taken out in shares. He had been recently at the mine, but as he addressed the shareholders as recently as last October he would not detain them very long upon the present occasion. They knew of the great discovery the Chairman had just alluded to in his opening speech, but which had not been thoroughly proved. The object was to drive the 112 west underneath, to unwater it. They had come upon very extraordinary hard ground; the shareholders who had accompanied him to the mine could hardly believe the great labour required in boring. During the last few weeks a favourable change had taken place, and he was not out of the mark in saying they were now making more than double the progress they had made during the last ten or twelve months. The manager had valued the ore left at Parry's at 3 tons of lead per fathom; some shareholders

BLAKE'S PATENT STEAM PUMP.

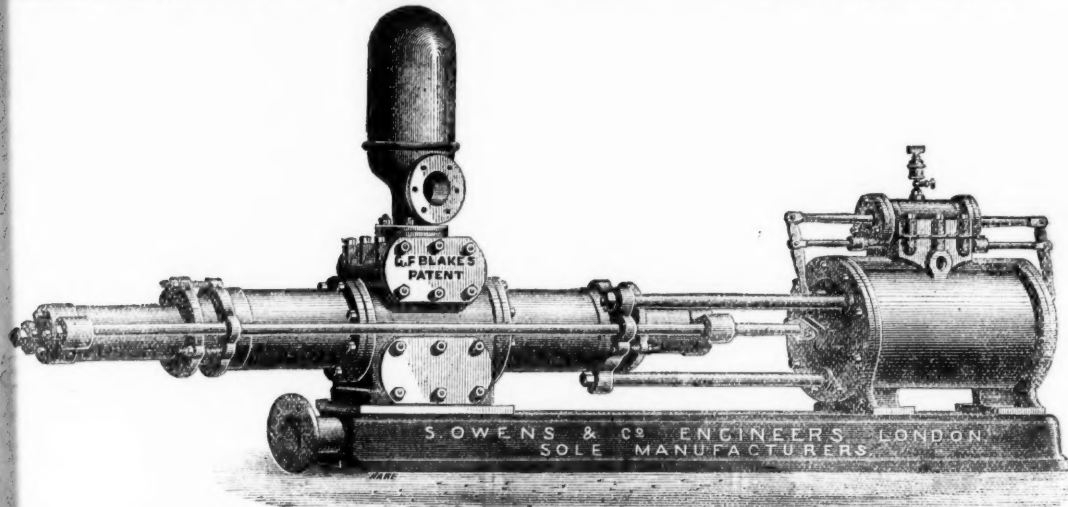
MORE THAN 8000 IN USE.

SOLE MAKERS FOR GREAT BRITAIN,

S. OWENS & CO.,

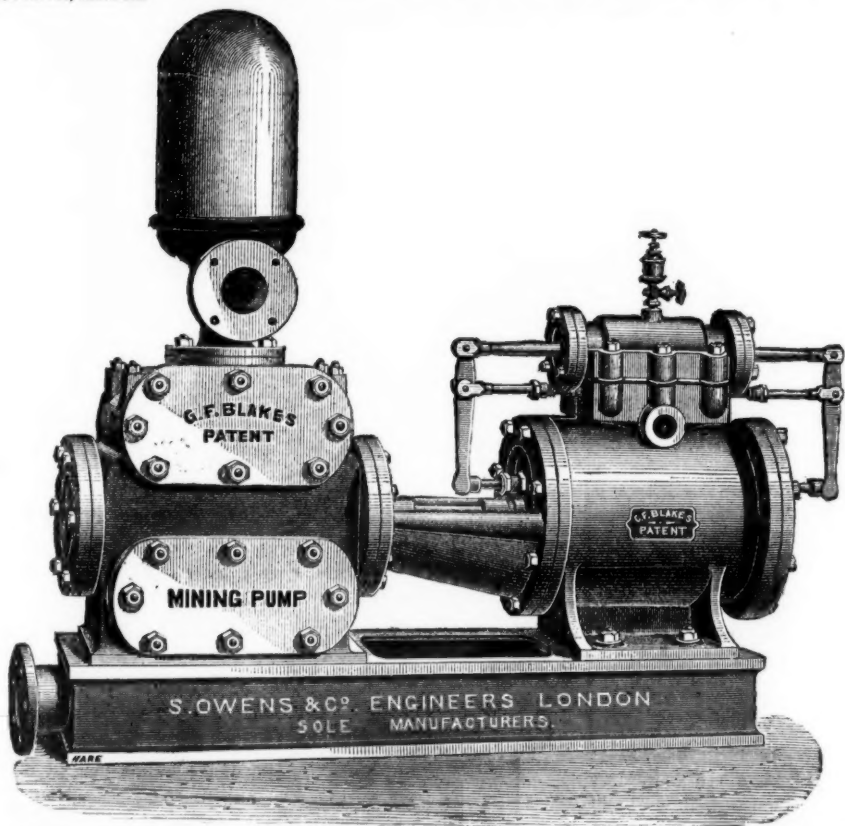
Hydraulic and General Engineers, Whitefriars-street, London;
And at 195, Buchanan-street, Glasgow (W. HUME, AGENT).

These PUMPS from their SIMPLICITY, RELIABILITY, DURABILITY, and ECONOMY are SPECIALLY SUITED FOR MINING PURPOSES, where large quantities of water require to be raised from great or medium depths with CERTAINTY. They are double-action in their construction, throwing a constant stream of water, can be made of any stroke to suit the space in which they have to work, can be arranged with any combination of steam and water cylinders to suit the pressure and lift against which it is desired to work them, are made of the very best materials and highest class of workmanship, and all working parts can be readily got at by any ordinary workman, and replaced if necessary by a duplicate part (all such being interchangeable) in the shortest possible time. For situations where gritty and sandy water has to be pumped the DOUBLE-PLUNGER PATTERN is recommended. Where space is limited the PISTON PUMP is better suited, a novel feature of which is the PATENT REMOVEABLE LINING, which can be removed in a few minutes and substituted with a new one, without disturbing any other part of the pump.



Blake's Improved Double-plunger Steam Pump.
S. OWENS AND CO.,

In placing the BLAKE STEAM PUMP before the mining world, believe they are offering the BEST, MOST RELIABLE, and ECONOMICAL PUMP that has yet been made, and solicit an inspection of various sizes in operation at their works, Whitefriars-street, Fleet-street, London.



Blake's Improved Mining Pump, with Patent Removeable Lining to Pump Cylinder,

Any combination of these Pumps may be had to suit circumstances. The following are some of the SIZES SUITABLE FOR MINING PURPOSES:—

Dia. of steam cylinders.. In.	12	12	12	12	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	24	24
Dia. of water cylinders.. In.	3	4	5	6	4	5	6	4	5	6	8	4	5	6	8	5	7	8	9	6	8
Length of stroke..... In.	18	18	18	24	24	24	24	24	24	24	24	24	30	30	30	30	30	36	36	36	42
No. of strokes per minute..	30	30	30	30	25	25	25	22	22	22	22	22	22	22	22	20	20	17	17	17	15
Quantity in gallons per hour, approximately ...	1440	2610	4200	5940	2940	4620	6600	2646	4158	5940	10620	2646	5160	7500	13260	4586	9000	12360	15660	6720	12000

PRICES FOR THE ABOVE, OR ANY SPECIAL SIZE, AND ILLUSTRATED CATALOGUES FURNISHED ON APPLICATION

PATENT CONDENSORS

supplied for any size pump to effect a saving of fully 30 per cent. in the consumption of fuel, greatly increasing their efficiency.
The Blake Pump will work under water, and as efficiently with compressed air as with steam.

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SOLID DRAWN BRASS BOILER TUBES

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BEST KNOWN MATERIAL.

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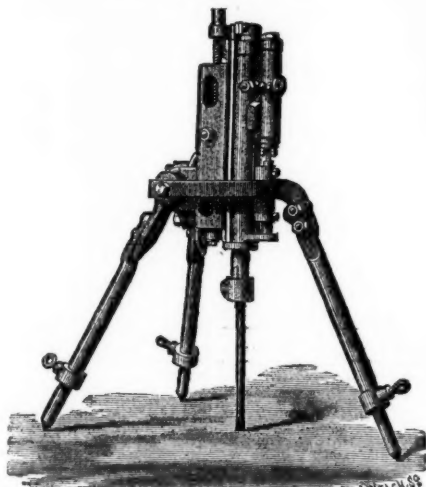
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from the very best quality of charcoal iron and steel wire.

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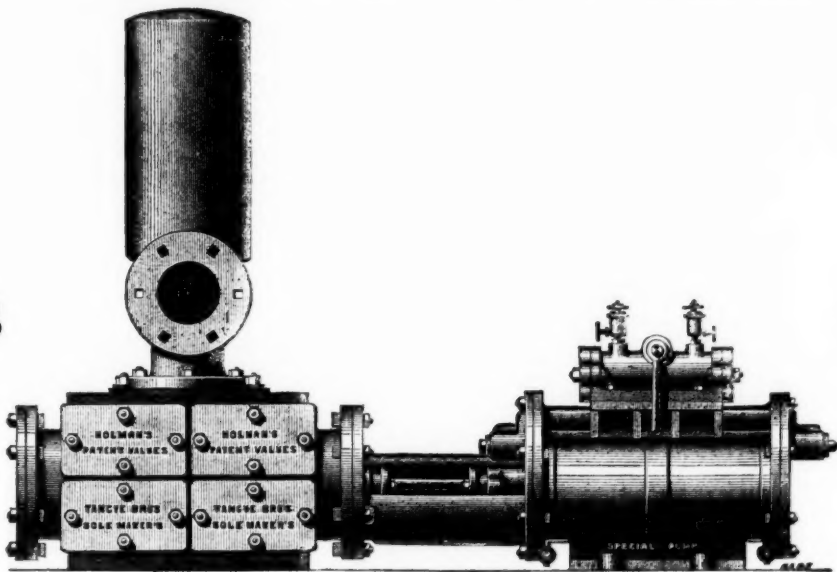
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GREAT REDUCTION IN PRICES.

The following sizes are suitable for low and medium lifts:-

Diameter of Steam Cylinder ...In.	3	4	4	4	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	
Diameter of Water Cylinder ...In.	1½	2	3	4	3	4	5	3	4	5	6	3	4	5	6	7	4	5	6	7	8	5	6	7	8	9	5	6	
Length of StrokeIn.	9	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	18	12	12	12	18	24	12	12	
Gallons per hour	680	815	1830	3250	1830	3250	5070	1830	3250	5070	7330	1830	3250	5070	7330	9750	3250	5070	7330	9750	13,000	5070	7330	9750	13,000	16,519	5070	7330	
Price	£18	18	20	25	22	10	32	10	25	30	35	40	30	35	40	45	50	40	45	50	55	65	50	55	60	70	85	55	60

CONTINUED.

Diameter of Steam Cylinder...In.	10	10	10	10	12	12	12	12	12	12	14	14	14	14	14	14	16	16	16	16	16	18	18	18	18	18	18	18
Diameter of Water Cylinder...In.	7	8	9	10	6	7	8	9	10	12	7	8	9	10	12	14	8	9	10	12	14	9	10	12	14	10	12	14
Length of Stroke.....In.	12	18	24	24	18	18	18	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Gallons per hour	9750	13,000	16,519	20,000	7330	9750	13,000	16,519	20,000	30,000	9750	13,000	16,519	20,000	30,000	40,000	13,000	16,519	20,000	30,000	40,000	16,519	20,000	30,000	40,000	20,000	30,000	40,000
Price	£55	75	90	100	75	80	85	110	120	140	110	120	130	140	160	180	140	150	160	180	200	190	200	220	240	200	220	240

Intending purchasers of Steam Pumps would do well to observe the great length of stroke, short steam cylinder, and short piston of the "Special" Steam Pump, as compared with the short stroke, long steam cylinder, and long piston of the Pumps of other makers, as the efficiency and durability of the machine, and the space occupied by same, greatly depend upon this. The advantage of long strokes will be obvious when purchasers are reminded that each set of suction and delivery valves of a "Special" Steam Pump with 24 in. stroke, running at 120 ft. per minute, would open and close only 30 times per minute, as against 120 times per minute in a Pump with only 6 in. stroke performing same duty.

The "Special" Steam Pump can be worked by Compressed Air as well as by Steam.

HUNDREDS of these PUMPS are USED for HIGH LIFTS IN MINES, for which purpose they are made with 21, 24, 26, 28, 30, and 32-inch Steam Cylinders, and 36, 48 and 72-inch Strokes.

Holman's Patent Self-acting Exhaust Steam Condensers,

FOR ALL KINDS OF STEAM PUMPS AND HIGH-PRESSURE STEAM ENGINES.

Turns waste steam into
GREAT POWER.

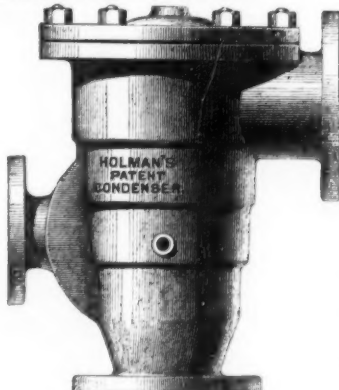
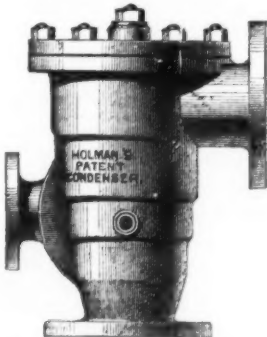
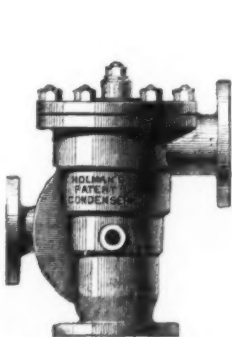
Saves 20 to 50 per Cent of Fuel.

Requires NO THREE-WAY COCKS,
CHECK, or REGULATING VALVES.

Saves HALF ITS COST IN PIPES AND
CONNECTIONS.

Prevents ALL ESCAPE OF STEAM IN
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Requires NO EXTRA SPACE.



These Condensers are made to suit any size and kind of Steam Pump. They form a part of the suction pipe of the Pump, and while they effectually condense the exhaust steam, they produce an average vacuum of 10 lbs. per square inch on the steam piston, increasing the duty of the Engine, and effecting a saving in fuel of from 20 to 50 per cent.

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Price from 30s. to 40s. per inch diameter of Steam Cylinder, according to the relative Diameter of Pump for which Condenser is required.

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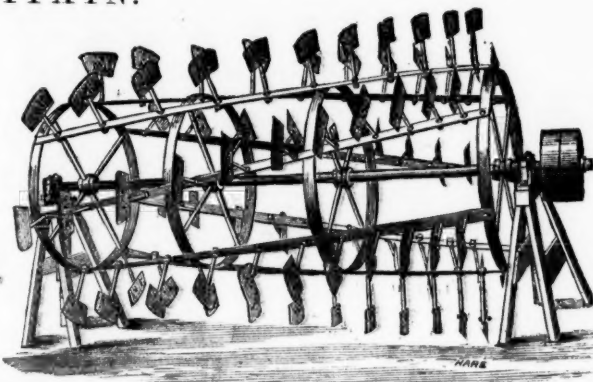
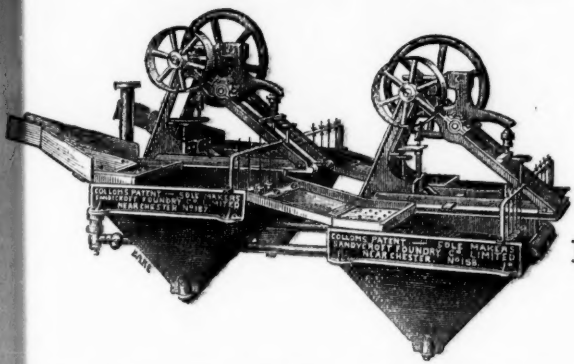
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AN INDISPENSABLE APPENDAGE TO STEAM BOILERS.



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In operation to
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SAVES
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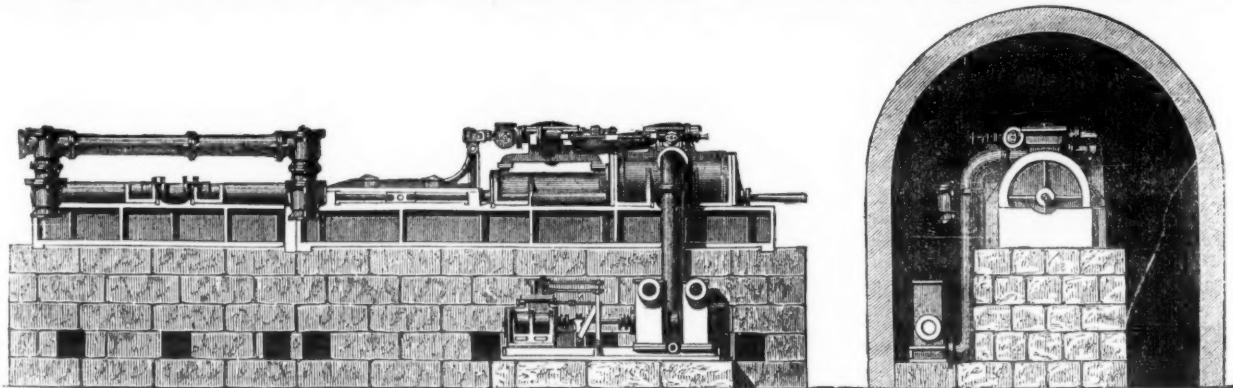
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THE COMPOUND DIFFERENTIAL ENGINE AND FORCE PUMPS,

With Separate Condenser, as applied Underground, forcing 700 gallons per minute 920 feet high.

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W. and S. FIRTH undertake to CUT, economically, the hardest CANNEL, ANTHRACITE, SHALE, or ORDINARY COAL, ANY DEPTH, UP TO FIVE FEET.

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(ESTABLISHED 1764.)
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EXTENSIVELY USED BY
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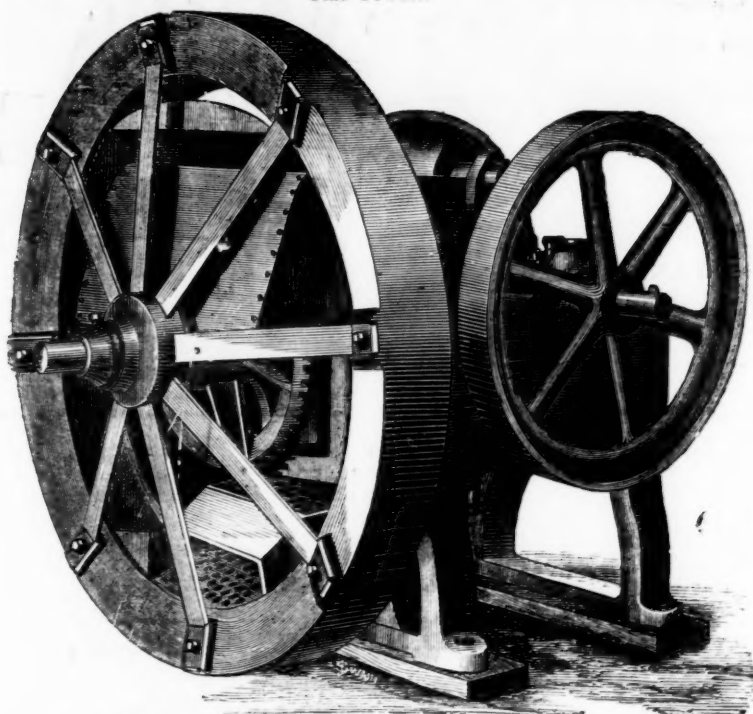
OVER 1150 NOW IN USE.

New Raff Wheel Machine, fitted with H.R.M.'s Special Jaws for Crushing Stone, &c. to Fine Powder.

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FIFTY GOLD AND SILVER FIRST CLASS PRIZE MEDALS, including the R. A. S.'s SILVER MEDAL, have been received in competition with other Stone Breakers.

Machines fitted with H. R. M.'s renowned PATENT CUBING JAWS, by which stone is broken equal to hand at ONE-TENTH THE COST.

FEW WORKING PARTS.
SMALL WEAR and TEAR.
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THE ONLY ORE CRUSHERS WHICH COMBINE AND EMBRACE THE TRUE PRINCIPLES OF ACTION AND CONSTRUCTION FOR THE PURPOSE DESIGNED.

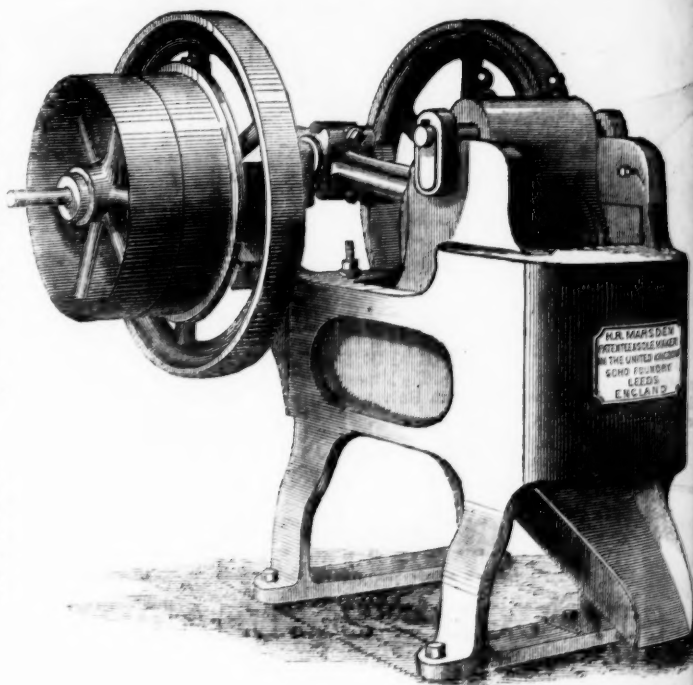
Great Improvements in Mining Machinery by the use of

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NEW RAFF-WHEEL MACHINE

WITH NEW PATENT CRUSHING JAWS,

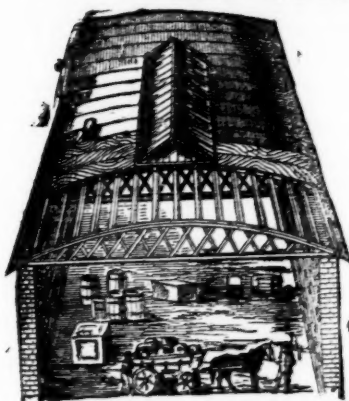
BY WHICH ORES OF EVERY DESCRIPTION CAN BE REDUCED TO FINE POWDER.



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GREAT ECONOMY
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The above drawing shows the construction of this cheap and handsome roof, now much used for covering factories, stores, sheds farm buildings, &c., the principal of which are double bow and string girders of best pine timber, sheathed with 1/2 in. boards, supported on the girders by purlins running longitudinally, the whole being covered with patent waterproof roofing felt. These roofs so combine lightness with strength that they can be constructed up to 100 ft. span without centre supports, thus not only affording a clear wide space, but effecting a great saving both in the cost of roof and uprights.

They can be made with or without top-lights, ventilators, &c. Felt roofs of any description executed in accordance with plans. Prices for plain roofs from 30s. to 60s. per square, according to span, size, and situation.

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INODOROUS FELT for lining damp walls and under floor cloths.

DRY HAIR FELT for deadening sound and for covering steam pip. thereby saving 25 per cent. in fuel by preventing the radiation of heat.

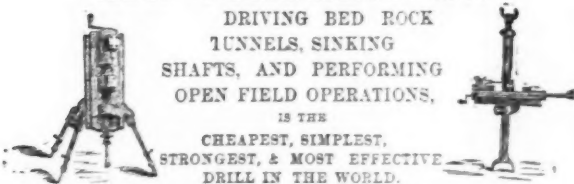
PATENT ASPHALTE ROOFING FELT, price 1d. per square foot.

Wholesale buyers and exporters allowed liberal discounts.

PATENT ROOFING VARNISH, in boxes from 3 gallons to any quantity required 8d. per gallon.

DUNN'S ROCK DRILL,

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DRIVING BED ROCK
TUNNELS, SINKING
SHAFTS, AND PERFORMING
OPEN FIELD OPERATIONS.

IS THE

CHEAPEST, SIMPLEST,
STRONGEST, & MOST EFFECTIVE
DRILL IN THE WORLD.

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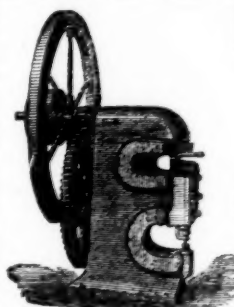
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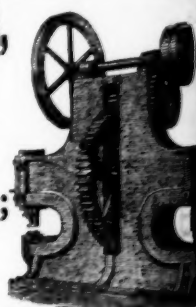
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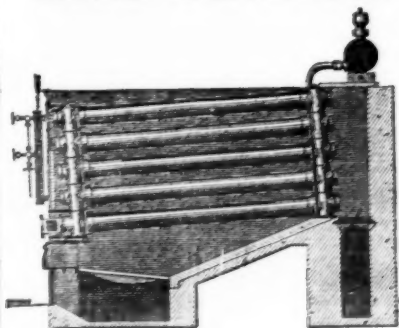
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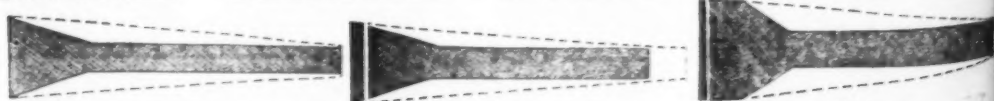
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